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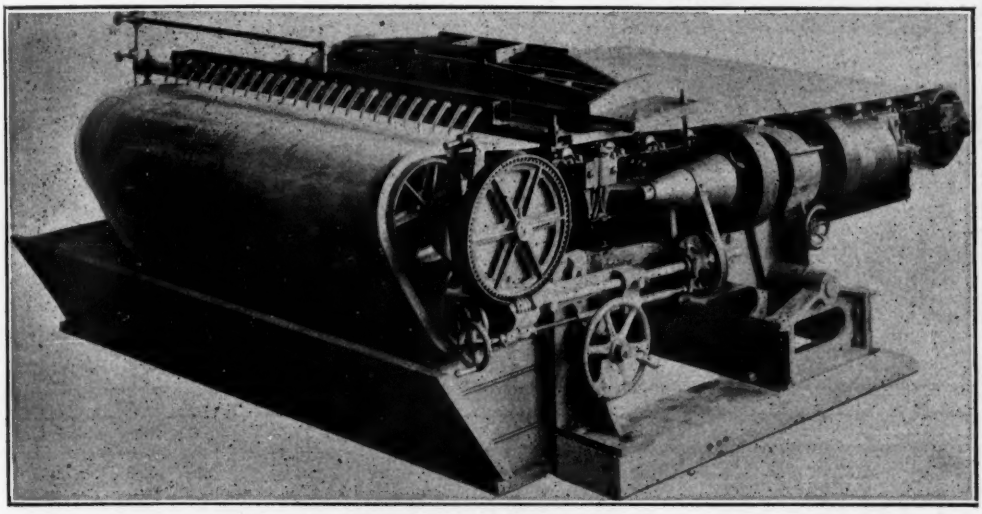

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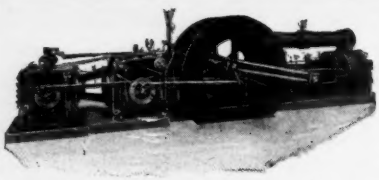

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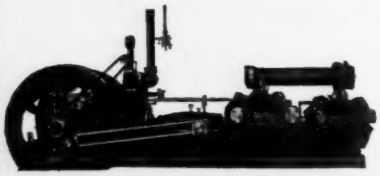

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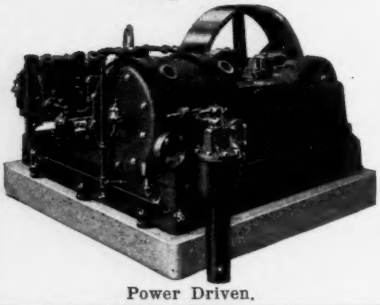

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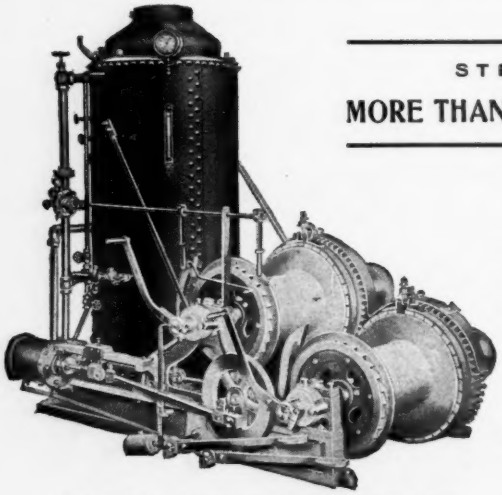

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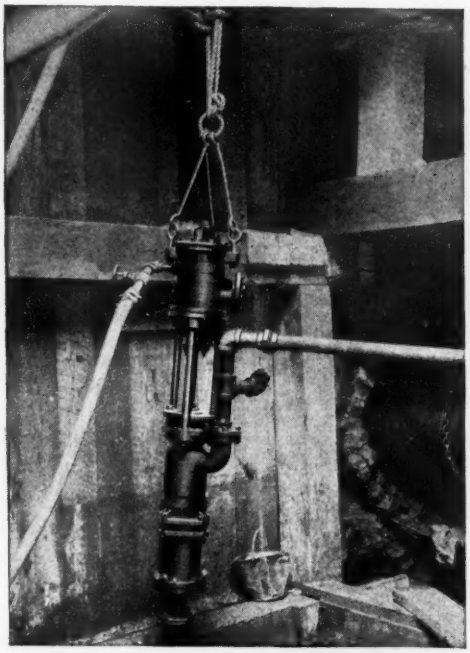

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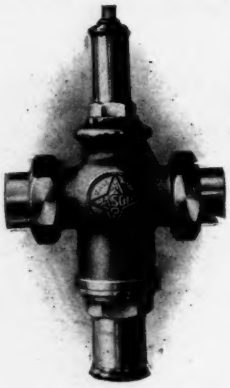

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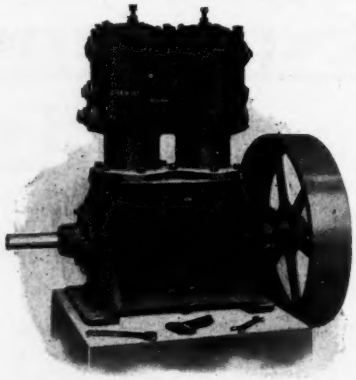

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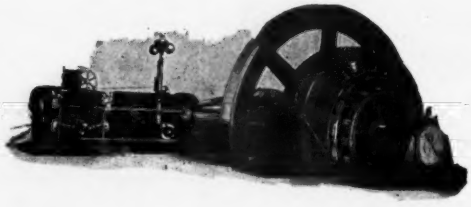

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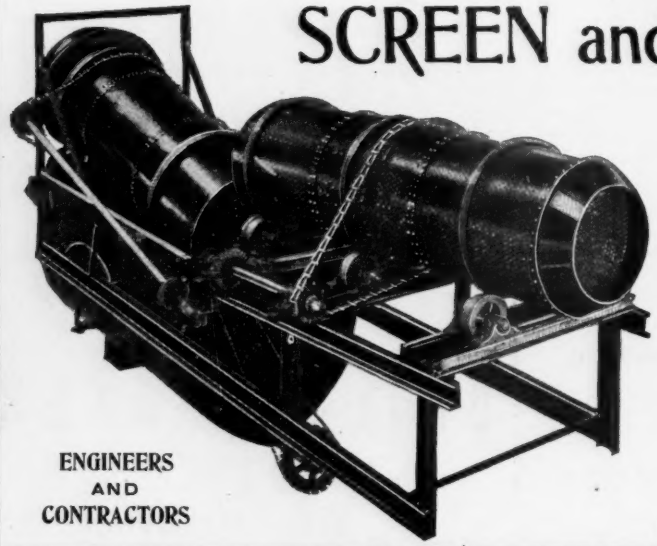

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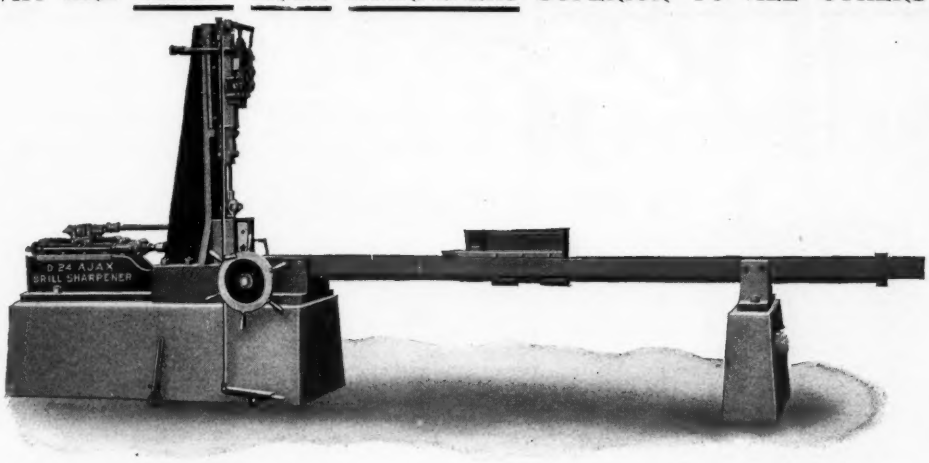

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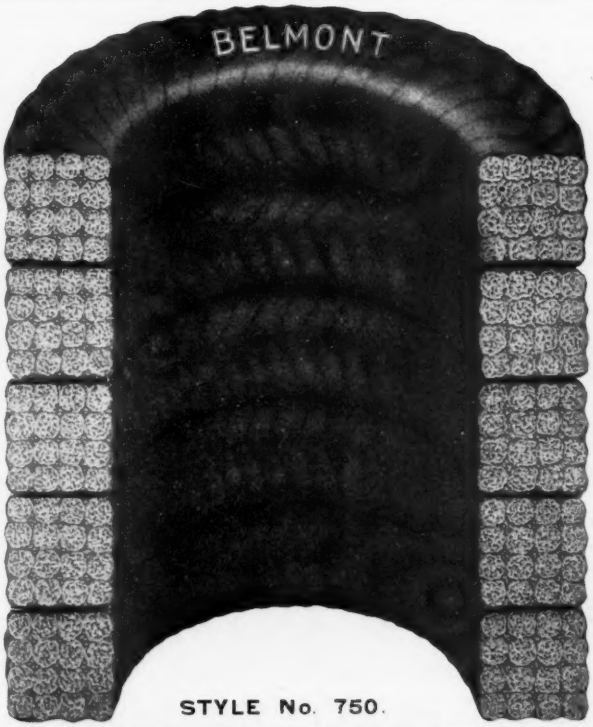

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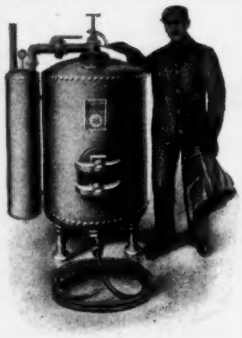

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A NOVEL AND INGENIOUS AIR HAMMER

It is now coming to be quite generally realized that for practically all classes and sizes of steam hammers compressed air is much to be preferred for the operating fluid. The improving and perfecting of the large air hammer, however, is given more attention in Great Britain than in the United States, so that we have frequently to notice new and ingenious developments in this line originating on the other side of the water. The illustrations which we here reproduce from *The Engineer,* London, show a new type of air operated hammer built by B. and S. Massey, Openshaw, near Manchester, England.

The points to be borne in mind by the designer of a steam hammer at the present day are concisely stated as follows: The clearance and back pressure losses must be reduced to a minimum; the air must be used expansively; the flow of air into the working cylinder after the blow has been struck must be prevented; and the working pressure of the air must receive due consideration. The reduction of clearance on the top side of the piston, at any rate, is not difficult of attainment, but on the lower end of the cylinder the hammer builder has to take into consideration the differing thicknesses of the work to be dealt with and the possibility of the sinking of the anvil block. On account of these factors a hammer in which air is alternately admitted to and exhausted from the lower side of the piston is liable to heavy clearance losses. Moreover, as the hammer falls with great velocity, which increases as the piston descends, back pressure is difficult to avoid in this type of hammer unless the ports are made of ample area when the clearance losses are increased.

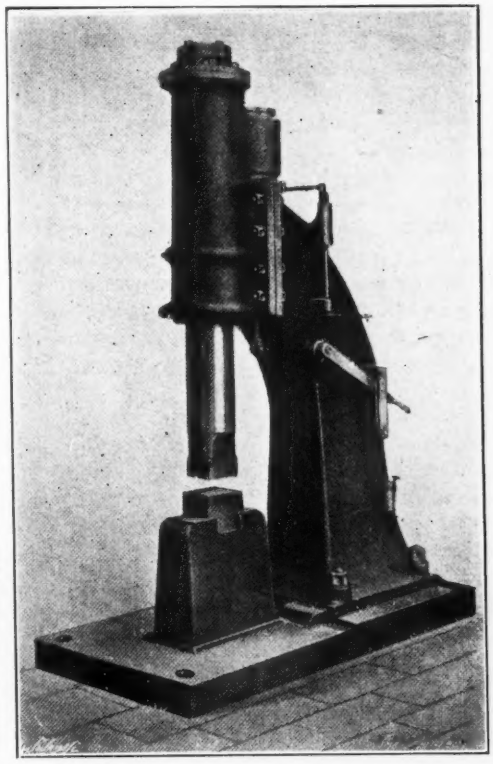


FIG. 1. MASSEY AIR HAMMER.

In the hammer here shown the space below the piston is always open to the pressure of the air from the compressor, this tending constantly to lift the hammer, whereas the air at the same pressure is alternately admitted to and exhausted from the top side of the piston. In this manner it will be seen that the only passage which has to be periodically filled and emptied, is a short one between the valve and the top of the cylinder, and the bottom

port may be as large as reasonably possible without entailing any waste of air. It becomes, in fact, a part of the air storage system. When the hammer is forced down, owing to the difference between the areas above and below the piston, the lifting pressure is overcome, and the energy is expended chiefly in striking the blow, but also in compressing the volume of air below the piston for the subsequent raising of the hammer. The amount of air required, however, is less than that required for a separate admission for each up and down-stroke, owing to the abolition of the clearance loss and the absence of back pressure.

Another feature of this new hammer is that the air is used expansively on all blows. A fixed cut-off takes place at about half-stroke, and as an expansion from one to two with air pressure at 45 lb. per square inch is calculated to give 90 per cent. of the maximum work in the air, a substantial gain is effected. For light blows an even greater degree of expansion is obtained by the hand movement of the valve, enabling the cut-off to be made before half-stroke. A further point in the design of this new hammer which adds to its efficiency, is the prevention of what may be termed "after-flow" of the air, into the top side of the cylinder after the blow has been struck. It is obvious that such a condition must be as wasteful of power as it is useless. The after-flow in some hammers is induced by the piston travelling so fast in the later stages of the stroke, that the air cannot enter the cylinder quickly enough to maintain the neseccary supply. The result of this is, that when the blow is struck, there may be only a low pressure on top of the piston, while after the blow air continues to flow in until the supply pressure has been reached. The arrangement for working expansively is claimed to prevent this.

A general view of the new Massey hammer is given in Fig. 1, while Fig. 2 shows very clearly the construction and arrangement of the cylinder and ports, and the cycle of operations. Referring to the three views in Fig. 2, it will be seen that the lower end of the cylinder is always in free communication with the air supply through a large port A, the constant pressure serving to keep the hammer normally in the raised position at the top of the stroke as in the lefthand view in Fig. 2. The air inside the ram below the central guide is used as a spring or cushion, being compressed on the up-stroke and expanded on the down-stroke. The combined effect of the two pressures—the constant one below the piston and the varying pressure within the ram—gives a resultant upward force which decreases as the ram approaches the top, a rapid and lively action being thus produced. When the piston valve is raised, as in the centre view in Fig. 2, the top of the cylinder is closed to the exhaust and put into communication with the bottom of the cylinder through the port B, and thus with the air supply. The compressed air, therefore, passes from the supply on to the top side of the piston and forces the ram down. As the ram descends the piston passes the port B, and in so doing cuts off the supply of air to the top of the cylinder. During the remainder of the stroke, therefore, the air already admitted is used expansively, and this expansion takes place no matter what kind of blow is struck, no further air being admitted. In order to permit of the striking of light blows with short strokes, a small port can be opened by the attendant's lever, admitting just enough air to allow the piston to fall. This port is closed again when the valve is moved further for a long stroke; while for "holding-down" purposes the second lever shown in Fig. 1 enables air at full pressure to flow into the cylinder, even when the piston is at the bottom of the stroke. To avoid confusion in studying the sectional views in Fig. 2, it should be stated that the piston valve has nothing whatever to do with the supply of air to the bottom of the cylinder, although it controls the flow between the ports B and C, and when rotated by the upper handle shown in Fig. 1 allows the full pressure to flow into the cylinder for the purpose previously mentioned.

Fig. 3 represents a typical pressure diagram for heavy blows taken at the full speed, 100 blows per minute. The sharp cut-off alluded to and the sustained expansion line and light back pressure are are all well shown. Fig. 4 is a diagram for light blows at a quick speed. In this case only a partial admission of air takes place, and the air being cut off early by the valve F begins to expand almost at the commencement of the stroke. This card also shows the diagram of the pressure below the piston, which remains the same for all blows. The small mushroom valve G, shown in the sectional views is intended for admitting the

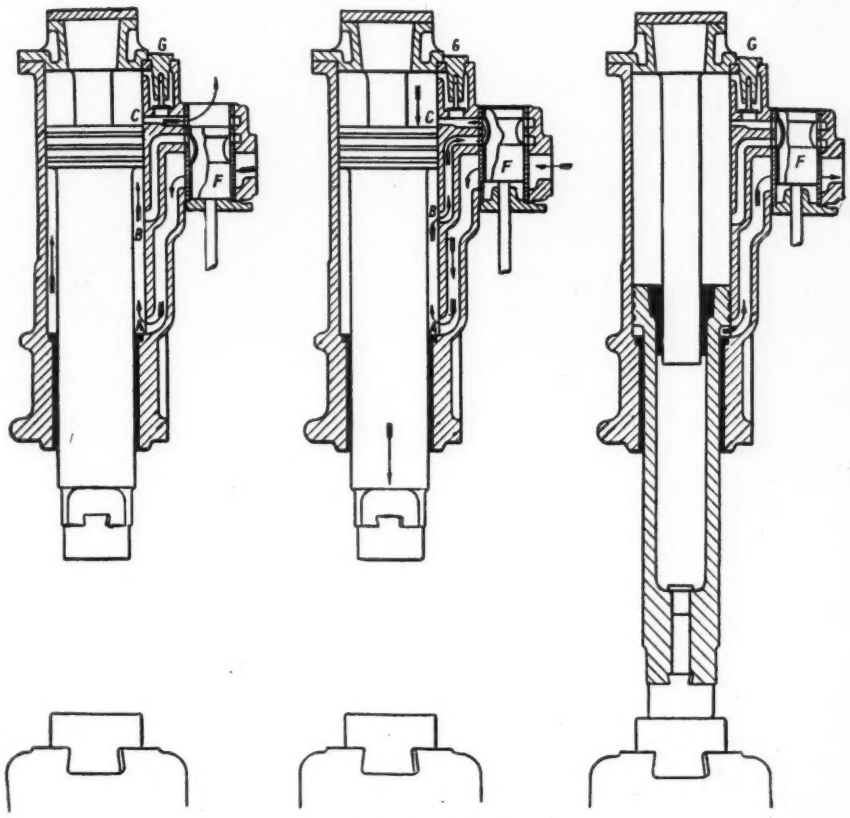


FIG. 2. MASSEY AIR HAMMER.

air pressure into the space on top of the piston in case the latter has risen above the port C. The hammer is specially adapted for smithy and forge purposes. The ram is circular in section, and works through a long phosphor bronze sleeve at the lower end of the cylinder. It is bored out centrally to receive an internal guide which is rigidly attached to the cylinder cover. The guide works through a phosphor bronze bush in the head of the ram, and is shaped so as to prevent turning. Being entirely enclosed, a perfectly air-tight fit is not necessary. The hand-operated valve gear resembles very closely that of a hand-controlled steam hammer, a separate movement being required for each blow. There is, however, no need for a "tripper," owing to the force on the upward stroke bereduced automatically as the ram rises.

The hammer is made in six sizes, namely, 3, 5, 7, 10, 15, and 20 cwt. The 5-cwt. hammer, which we have seen in successful operation, has a ram 9½ in. diameter, maximum

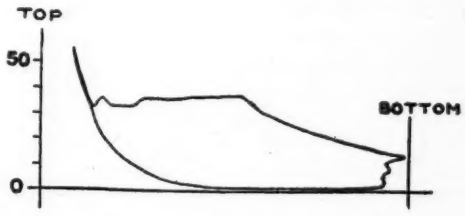


Fig. 3

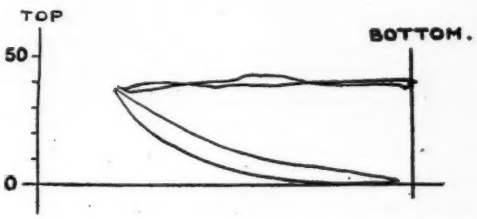


Fig. 4

stroke 24 in., and weighs complete about 5½ cwt. The overhang to the pallett centres is 24 in., and the total height from the floor 9 ft. It was operated by air at 45 lb. pressure. The following are the particulars of the average and maximum power consumptions, etc.:—

Maximum—(*a*) number of hardest blows per minute, 100; (*b*) cubic feet of free air per minute for above, 310; (*c*) size of compressor for a single 5-cwt. hammer, in cubic feet of free air per minute, 280; (*d*) approximate power required for pressure of 45 lb. per square inch, 35 brake horse-power. Average —(*e*) cubic feet of free air per minute, 38; (*f*) approximate power required for pressure of 45 lb. per square inch, 4.5 brake horse-power. These powers are based on the assumption that the compressors require for a pressure of 45 lb. per square inch 12.5 brake horse-power per 100 cubic feet of free air per minute.

THE SHOCKLESS JARRING MACHINE

It will be remembered that in the preceding issue of COMPRESSED AIR MAGAZINE we described a portable jolting machine. This type of machine, in which sand ramming is dispensed with and the requisite solidity of mold is secured by simply raising the mold and suddenly dropping it a sufficient number of times, seems to be coming rapidly into use. Hitherto, machines of this type have been used for flasks which could be handled by one or two men, but in the nature of things there is no reason why the same principal should not be applied to molds much heavier, and accordingly we find in the latest issue of the *Journal* of the American Society of Mechanical Engineers a paper by Mr. Wilfred Lewis, of Philadelphia, in which the use of larger machines is discussed. The added complication in the handling of much heavier flasks is in the shock given to the surroundings when the drop occurs. This would be prohibitive, but it is successfully avoided in the Shockless Jarring Machine, which is the subject of the paper referred to. Our space only permits an abstract, and even this is all too long.

The jarring machine is essentially a sand-packing machine, capable of ramming any mold, large or small, in a minute or less time. By the method employed, the sand is rammed, as it should be, densest at the surface of the pattern and of decreasing density above, thus favoring the escape of gases when the mold is poured. The packing of the sand results from impact between the table on which the mold is carried and the anvil on which it drops. Various means may be used to lift the table and let it drop, but in foundry work compressed air has come to be generally preferred for its convenience as a medium for the transmission of power, and also for the simplicity of the machines resulting from its use.

During recent years, while the power squeezer and the split-pattern machine were completing their development, the much neglected jarring machine has grown steadily in favor and in size, until to-day there would seem to be no limit to its capacity. These machines are simple in construction and effective in operation, while on large work the saving to be effected by their use probably exceeds that by all other types of molding machines combined. If it takes two men eight hours to mold by hand a certain pattern, in a flask 45 in. by 60 in. by 36 in., and if five hours of this time is consumed in ramming sand, a jarring machine would save practically five hours of the time. It would not save any of the pattern-drawing and finishing time, nor any of the time for setting cores, but it would enable two men to make the mold in three hours, instead of in eight hours by hand.

The damage that may be caused by the action of the jarring machine upon finished molds, or even upon buildings in the neighborhood, and the annoyance caused by noise and ground waves generally, call for serious consideration. This damage and annoyance has increased steadily with increase in the size of the machines and in the weight of the loaded table. To meet these serious objections, various expedients have been adopted, among which may be mentioned a reduction in the stroke or drop, and a more or less resilient bedding for the anvil. These palliatives, however, left much to be desired until the shockless jarring machine, with its anvil rising up to meet the falling table was developed. This has eliminated the chief objection to jarring machines.

In the molding machine to be described, the table adopted has been formed in one piece with the jarring cylinder, as shown in section in Fig. 2. This table has great depth of

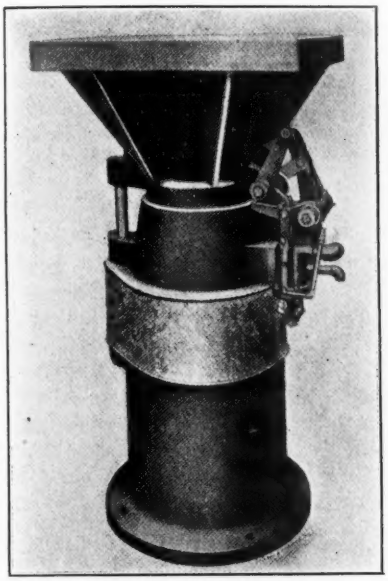


FIG. 1.

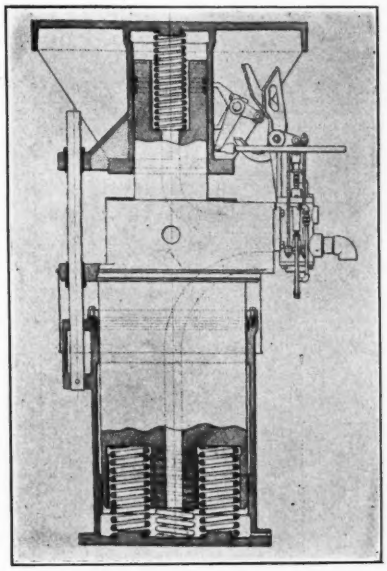


FIG 2.

beam, and the metal is distributed as it should be for economy of cast iron, in a broad expanse of plate on the tension side, and a smaller mass around the cylinder on the compression side, where the blow is struck. Radial ribs connect the tension and compression sides of the beam, forming a table of enormous strength and stiffness to distribute the central blow of impact equally in all directions. There is no perceptible vibration of the table when it strikes its anvil, or rather the buffer ring of leather, or other non-resilient material, interposed to relieve the sharpness of the blow and to reduce the noise. This buffer also helps to reduce vibration and rebound, by reducing the intensity of the force of impact. It is not, however, the rebound of the table from its anvil that injures a mold, so much as the rebound of the flask and sand from the table. Solidity of contact between table, pattern board and flask, is one of the most important elements for the successful working of a jarring machine. Unlimited power may be expended in jarring sand to any given density; and since there is a certain maximum density corresponding to any given drop, it is also quite evident that efficiency increases with the drop, and decreases with the dead weight handled over and above the weight of sand used. With air as a working fluid the benefit gained by expansion on light work offsets to a great extent the loss from the greater proportion of dead weight carried, giving to the jarring machine which uses air expansively in its cylinder quite a wide range of capacities.

The shockless jarring machine consists, in its usual form, of a jarring table mounted upon an upstanding plunger forming the anvil, which in turn is mounted in a cylinder base and supported upon long helical steel springs. Compressed air, as the working fluid is admitted through an automatic valve, under hand control, attached to the plunger or anvil base, and passes first into the jarring cylinder to raise the loaded table. At some predetermined point in the table movement, the air is automatically cut off from the cylinder, and while the valve is reversing, the confined air will expand and lift the table further from its anvil, provided its initial pressure exceeds the balancing pressure due to the weight carried. Then, when the operating valve completes its reverse movement the air from the jarring cylinder may be exhausted into the atmosphere, but preferably it passes from the jarring cylinder to the anvil cylinder beneath, and the table drops by gravity against the reduced pressure in its cylinder. At the same time, the plunger base or anvil is reliev-

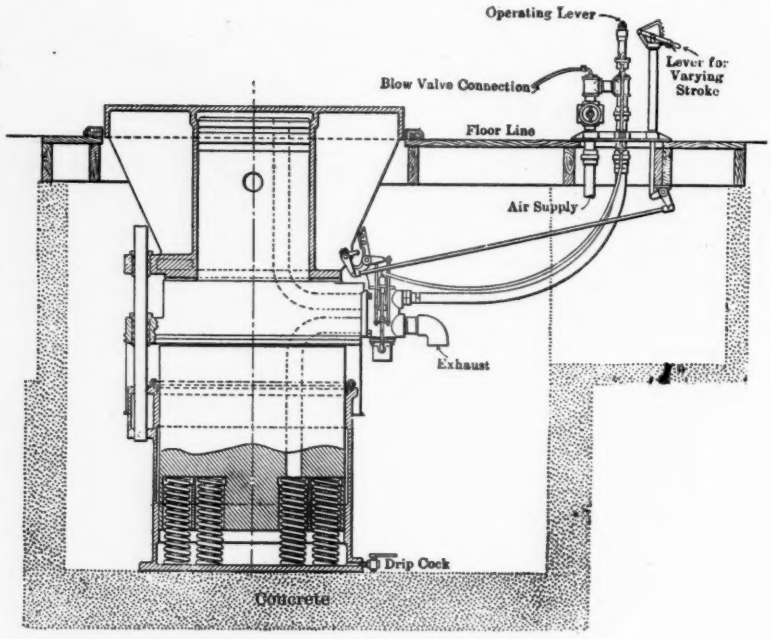


FIG. 3.

ed of a considerable part of the load carried by its supporting springs, which immediately expand, giving the anvil an upward velocity to meet the falling table. When air is expanded from the jarring cylinder into the anvil cylinder this upward velocity of the anvil is augmented and the falling velocity of the table is somewhat retarded, but in any case the momentum of the rising anvil is substantially equal to that of the falling table at the instant of impact. As a result, both table and anvil come to rest with great jarring or ramming effect upon the sand, but without shock or jar upon the foundation of any surrounding material.

When the air from the jarring cylinder is discharged at once into the atmosphere the momentum of the falling table may somewhat exceed that of the rising anvil at the instant of impact; but when this air is expanded into the anvil cylinder it compensates more or less for the loss of spring pressure as the anvil rises, and in this case the momentum of the rising anvil may exceed that of the falling table at the instant of impact. The difference, however, need not be very pronounced, and simply results in a slight initial velocity of the table and anvil at the beginning of the next stroke.

The advantage of the second expansion is two-fold: it utilizes the potential energy of the compressed air in augmenting the momentum of the anvil, and at the same time it checks the acceleration of the table due to gravity and holds it in contact with the load upon it while falling. Otherwise a poorly fitted pattern board or flask may tend to spring away from its support while falling and cause lost motion, productive of a bad mold. For the same purpose, when the air is discharged directly from the jarring cylinder, a long compression spring between the jarring cylinder and its plunger may be introduced with good effect. In several instances such springs as shown in Fig. 2 have been made to carry half the weight of the table with 8-in. compression. They assist in lifting the loaded table, and retard its acceleration in falling; and by their use the lifting capacity of jarring tables may be considerably augmented. Their chief purpose, however, is to retard the falling table and hold the pattern flask and sand firmly against it in readiness for the coming blow. With such a spring, the action of the table is, of course, somewhat slower in falling and more stroke is required to produce a given velocity of impact. On the other hand, the table rises fast-

er and runs further to produce a given blow, and the increased stroke reduces the percentage of clearance space to plunger displacement. The spring in this position has, therefore, some beneficial effect upon the consumption of power, while serving a much better purpose, in the production of good molds, and although not so important when the air from the jarring cylinder passes through the anvil cylinder, it may be of some value in that case also.

Fig. 3 represents the design of a machine now being built for a large foundry to handle half-molds weighing 25 tons. The table is a steel casting 8 ft. x 12 ft., with lifting cylinder 3 ft. in diameter, and the plunger base forming the anvil is a solid iron casting weighing 65,000 lb. This is carried upon 22 steel springs, designed to compress 8 in. under the maximum load and to develop a working stress of only 60,000 lb. per sq. in., which is very much less than the usual working stresses on railway car springs and quite within safe limits. The total weight of the machine complete will probably be in excess of 90,000 lb. This is carried in a concrete pit designed simply to protect the machine and to support the static load on the floor of the pit.

PNEUMATIC HAMMERS IN USE

The following which we reprint (slightly abridged) from *Machinery*, written by Mr. George H. Hayes, works manager of the Chicago Pneumatic Tool Company, applies equally to all makes and styles of pneumatic hammers, and should help to secure for them appreciation and more considerate and careful treatment.

The material used in the construction of pneumatic hammers is the very best that money can buy and is the result of long periods of experimenting at an outlay of a great deal of time and money to get material that is best able to withstand the vibrations, jar and wear which pneumatic tools are called upon to withstand. The treating of the material, fitting up, and testing, must be done by experienced and competent men. Pneumatic tools are made with the most extreme care, the moving parts are accurately and closely fitted, and when the proper lubrication is neglected, which is the most unpardonable offense to which a piece of fine machinery can be subjected, the moving parts of a pneumatic hammer, will wear rapidly and in a very short time refuse to work.

Another source of trouble is sometimes located in the pipe line. Moisture carried in the air will rust the pipes and if a hammer is connected up without first blowing out the pipes a sediment is liable to be blown through into the tool, causing the valve or piston to stick. Rubber deteriorates very fast and particles of the hose may blow into the valve box and stop up some of the parts. Many times we have had hammers that would not operate, sent in to the factory, and on dismantling them found the port holes plugged up with pieces of rubber, or sediment from pipes, which when thoroughly washed out with gasoline, reassembled and properly oiled, would operate perfectly.

Another abuse is practiced in taking a hammer apart and putting it together again. Some repair men, instead of using a wrench or soft hammer in loosening or tightening the handle, use a hard steel hammer, battering the parts badly and in many instances breaking them. The finished parts should never be struck with anything but lead or copper hammers, and even when this is done, good judgment should be used as to the strain put on the threads of the handle and the cylinder.

THE SHORT PISTON TRICK.

There are many abuses in connection with the operation of pneumatic hammers which are hard to locate, one of the most flagrant being the use of short pistons in riveting hammers. The manufacturers, after long and careful experimenting, have decided on a piston of proper length to perform satisfactorily the work for which the tool was designed, and all parts are made in proportion to withstand the strain. Workmen who are anxious to perfrom their day's task in the shortest possible time, or to increase the volume of work where they work on a per-piece basis, have little or no regard for these labor-saving devices. Having discovered that pistons a fraction of an inch short will do the work more rapidly, they resort to all manner of means to secure them, even having them made in outside machine shops. They carry them in their pockets and when they take the hammer from the tool room, they substitute the short piston for the one of proper length, again making the exchange before returning the hammer. The

result is that sets and handles are broken and cylinders frequently split. Where these breakages are occuring at short intervals, it would be well to detail someone to go through the shop and examine the pistons while the hammers are in use, otherwise the cause of the breakages will not be definitely located.

Some of the large plants using pneumatic tools, have adopted the practice of issuing a given tool to the same workman continually, which has had a tendency to cause better care to be taken of the tools. If breakdowns occur frequently, it enables them to compare the amount of work being accomplished by different tools, and the more careless workmen are located and disciplined. Where this practice is followed, many times when the output of the shop is being forced to such an extent as to require all tools in service, and a workman is delayed in completing his work, while the men who are more careful of their tools finish in good time, it has a tendency to cause others to exercise greater care, which accrues to the benefit of all parties interested, even back to the manufacturer.

A great majority of men who operate pneumatic hammers in the shops, know very little, if anything, about the construction of the tools, and it pays any large institution using pneumatic tools to employ a competent man to look after them, see that they are properly lubricated and returned for cleaning when through with their work. I have been in foundries using large numbers of hammers in cleaning and shipping castings, where, at the sound of the whistle the hammers would be thrown down, generally in the sand, and enough sand or grit would get into the tool, so that when the air was again turned on the piston would stick fast after one or two blows. This necessitates a cleaning of the tool causing a loss of time in its use of from twenty to thirty minutes.

WORKING IN COLD WEATHER AND ON HOT RIVETS.

In starting to drive rivets in cold weather, especially on structural or out-of-door work, the hammer should be warmed up enough to take the frost out of the steel, as a hard piece of steel full of frost is liable to break at the first blow; after a few rivets have been driven, there will be enough heat from the rivets to keep the frost out. On the other hand, never allow the temper in the rivet set to be drawn too low, as a soft set will break very quickly. When driving rivets rapidly, have a pail of water handy and put the set and end of the hammer cylinder in the water occasionally to keep from drawing the temper, or change the set occasionally.

The wearing of parts in a hammer will always take place, but the life of the tool can be prolonged greatly by proper care and attention. Crystallization of the steel takes place owing to the rapid blows of the piston and the vibration. The life of the hammer depends mostly on the care which it receives and the character of the work being performed with it. A piece of fine machinery, such as a pneumatic hammer can be ruined in a few minutes by ill usage and neglect.

It has been proved conclusively during the past few years, that pneumatic tools are invaluable in shop practice wherein they are adaptable. Either a small or a large installation of pneumatic equipment may be the most economical in maintenance cost. The small installation does not require a special attendant, but can be looked after by the regular mechanical force, reducing the labor charge to a minimum. With an equipment consisting of forty tools or more, it should be put in charge of a special machinist whose duty it is to follow the equipment closely and to keep it in good repair. It has been clearly proved that one man can care for one hundred tools where the proper attention is given by the men handling them. We have recently had our attention directed to tools in service which have been working regularly for seven years. These tools, of course, have been well cared for, and the workmen using them appreciate their value in aiding them in their labors and handle them as they should be handled.

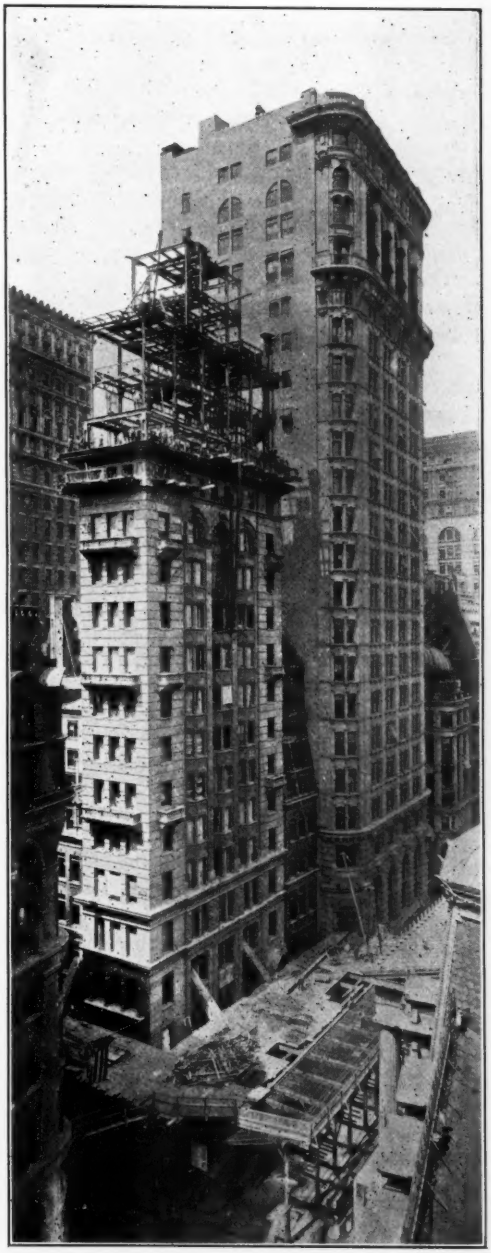
Pneumatic tools are outrageously abused in many cases without the knowledge of the management, and at other times with their sanction, the latter being on account of these tools having such a large earning power that they are considered an economical investment even through their life be but three months. This latter remark may seem an exaggeration; however, it is borne out by actual knowledge. One of the largest steel concerns in the world is using chipping hammers where nine hammers in the hands of men skilled in their operation easily perform work which would require ninety unskilled men with mauls and

cutters. The tools in this case are appreciated by both the management and the workmen and are well cared for. Even when the tools have a short life, a great many concerns having adopted them state that the saving in wages and increased output make them an extremely economical investment.

PULLING DOWN A SKYSCRAPER

One of the most interesting of recent operations in the building line has been the tearing down of the 19 story Gillender building at the corner of Wall and Nassau streets, the very center of the financial district of New York City, preparatory to the erection of the 39 story Bankers' Trust building upon the same site, with some additional area on each street. The Gillender building was at the time of its erection, 1896, the tallest office building in the world, a typical and quite up to date steel frame erection, with pneumatic caisson foundations, costing half a million dollars, and the job of pulling down such a building had never before been encountered.

A contract was made with the Volk House Wrecking Company, 56 Beaver Street, N. Y., for the demolition and removal of the building within 45 days for the sum of $50,000 with a penalty of $500 for each day over that period. The company, having a record of over 900 buildings already removed, of course went at the work in a business way. The streets were bridged entirely across, as seen in the half tone, the covering being heavy wire netting instead of planking. Of course compressed air was employed instead of manual labor for the actual disruption of the material. Two Ingersoll-Rand, R. C. compressors were set up in the cellar and a pipe was run up with manifolds for connections at each floor, and valves which could be successively removed as the building lowered. Ten Imperial No. 5, Type E, heaviest chipping hammers were constantly in service, these being used more for cutting out the brick work, especially around the steel columns, than in the separating of the steel frame itself. Mr. Alfred Volk, in active charge of the work, says that in freeing the masonry around uprights and beams each hammer accomplished the work more rapidly than six men with sledges, bars and chisels. There were 250 men employed during the day and 100 at night, and the job as a whole was the most formidable, most rapid and most entirely successful house-wrecking feat in the world's history.



TEARING DOWN A SKYSCRAPER.

The contract for destruction and removal naturally ends at the ground level, and then the work of excavation and the sinking of the foundations begins. Although the Gillen-

der building was supported upon pneumatic caisson foundations carried down to bed rock at a depth of about 60 feet below the curb level and these are to be entirely removed, this will not be done at the beginning. The contract for the foundations, including the removal of the Gillender caissons has been given to The Foundation Company, 115 Broadway, N. Y. Around the perimeter of the lot 15 narrow rectangular caissons will be sunk and banded together by watertight joints, these forming then an enclosing concrete wall about 7 feet thick reaching from 26 feet down to 60 feet below the street, where the rock is found, and to the rock a watertight band will be made to prevent any flow of water or quickstand into the interior of the lot. When this cofferdam is completed the excavation of the interior of the lot, including the removal of the Gillender caissons, will all be simple open air work. The new Bankers Trust building will have three full stories below the street level, the lowest to be devoted to the service of the building and the power plant, and the other two to be occupied by great storage vaults.

MINERAL RESOURCES AS THE BACKBONE OF PROSPERITY

By W. L. Saunders.

The backbone of prosperity in the United States, as in any other country, is in its mineral resources. A great agricultural country remains forever poor, notwithstanding the enormous value of the products of the land. This is because agriculture alone does not build up concentrated districts where population and prosperity contribute to the accumulation of wealth. Take India, for instance, with its enormous land values; the country produces much, but the people are poor. The same argument applies to China. Farms occupying large territories produce wealth, but the population required per acre is small and the profit goes largely to capitalists in other countries to which the product is exported. Russia, with its large fields, has always remained a poor country—rich only in the volume of its territory, but with a few large cities and comparatively little growth.

The reverse is true of England. Here we have a country with little or no agricultural opportunities, yet rich beyond the dreams of avarice. It is comomnly said that the wealth of England comes from her colonies, and this is true to a great extent, but the inherent wealth of England has enabled her to draw from and maintain colonies. It is because of the mineral resources of England, together with her vast shipping interest, that this small territory has maintained its supremacy in the world.

The United States occupies a unique position, in that it contains both agricultural and mineral wealth, the two combining to place the country upon a footing as a great manufacturing community. Agriculture without mineral resources does not build up manufacturing interests, but mineral resources alone may produce a great manufacturing country, because the product of the mines added to that of the works produces wealth sufficient to enable the proprietors to buy food from other parts of the world. England, without her ships, would not have made such progress. The United States does not need the ships, because it is not necessary for her to go beyond the limits of her own soil to produce practically everything which goes to make up the prosperity of her people.

To go further in illustrating the importance of mineral resources, let us take the State of Pennsylvania and compare it with Massachusetts, Connecticut or other States of the Union. It has been said that one might wall in the State of Pennsylvania and live in prosperity and happiness without calling upon any other State to furnish any of the sinews of life. See how rapidly Pennsylvania has progressed and to what extent the State has accummulated wealth as compared with other even older States of the Union. The great coal fields of Pennsylvania, combining with her iron and other mineral products, have been the real source of her wealth. England may well be compared with the State of Pennsylvania. The wealth produced by the English coal mines and the iron from the Cornwall district have built up her manufacturing interests and have laid the initiative in developing her resources and in adding to her wealth.

We seldom realize what the mineral resources of the United States have done in enticing immigration and in building up the country. The Argonauts of '49 trekked across the desert plains of the West to the deserted and barren fields in California and Nevada, but the gold and silver which drew them there were the real foundation stones which made

the great West what it is to-day. Does anyone realize the enormous growth of the Northwest since the discovery of gold in Alaska? Seattle, Tacoma, Spokane, Portland and other cities in that vicinity have boomed beyond the dreams of anyone, not because of any special advantages in these communities not possessed by others to an equal degree, but through the great advertisement of gold in the West, followed up by the actual product which has been taken out of these fields.

There is no section of the United States so blessed in natural resources as the South. In agriculture it has broad and rich fields, not only for the production of food of all kinds, but with the added wealth of cotton and tobacco. The South is also a great mineral country, with an abundance of coal, iron, marble, granite, etc. It is near the center of population, close to navigable rivers and harbors, it has railroads traversing its fields, and yet the South has not progressed as the natural advantages of the country would warrant.

Why is it? The answer is, that the country was devastated by a fierce civil war which destroyed its population and wealth, and from which it has taken at least a quarter of a century to recover. It is a conservative statement to say that the Civil War set the South backward at least 25 years, and the results of the Civil War have still further retarded the growth of this section. By results of the Civil War I mean particularly the political conditions, between whites and blacks, a struggle for supremacy, which has resulted in drawing party lines sharply. Any community where there is a preponderance of one political party is put at a disadvantage before the world, especially so when seeking capital. We see this in commercial affairs every day. An issue of bonds is made, and the capitalist who is asked to subscribe looks into the collateral security behind the bonds. He studies the ratables, and the price of the bond is fixed accordingly. Where a community is rich, prosperous and peaceful the bonds bear a premium; where conditions are disturbed by insurrections or political disturbances the value is reduced accordingly. This is seen in the high rate of interest paid on Japanese and South American securities, and where interest rates are high there is always an indication of discouragement of capital to develop resources.

Time alone can heal the blight of the South, and those of us who love the country should rejoice in the prospect which is before us. Conditions are certainly improving, as, in fact, there has been a steady improvement for a long period of time. No artificial stimulus could have changed the situation, because the war and the results of the war produced a condition which was beyond the power of human effort to overcome, except through a period of time.

The wealth is there, and has always been there, and, in fact, it is greater now than ever, because the old mines of the world are being worked out, capital is looking for new fields, and, besides, there is an enormous increase in the demand for mineral products. In addition to this, transportation facilities have been increased. To give one an idea of the increased value of the mineral products of the United States it is only necessary to refer to the reports of the Geological Survey, which show that between 1899 and 1908 the output of pig-iron, for instance, has increased in value from $245,000,000 to $254,000,000, while silver (in which the South has no special interest) has decreased in the same period from a little less than $33,000,000 to $28,000,000; gold has increased from $71,000,000 to $94,500,000, while copper shows a growth from $101,250,000 to nearly $124,500,000. Bituminous coal, a product of the South, has increased from $167,900,000 to $374,100,000. The output of stone, an important product of the South, has doubled in value in the period stated.

Minerals laid in ores of low grade, which a few years ago were comparatively worthless because of the cost of reduction, are now valuable. This applies particularly to iron, coal, gold and copper, and it is a reasonable supposition that as time goes on still further improvements will be made, thus bringing into the world's market mineral properties which now lie dormant.

A remarkably fast piece of track-laying was recently accomplished in Syracuse, N. Y., on the Syracuse, Lake Shore & Northern Railroad, when 3,720 ft. of 56-lb rail, weighing a total of 69, 440 lbs., was taken out and replaced with 70-lb. rail, weighing a total of 86,800 lbs., in 21 minutes and two seconds.

NEW YORK MUNICIPAL OFFICE BUILDING.

NEW YORK MUNICIPAL OFFICE BUILDING FOUNDATIONS

Building operations on the most stupendous scale are familiar features of New York City progress, and perhaps never more so than at the present time. Erections making new world records are in progress and more are being planned and contracted for, both public and private interests being represented. A railway station the most extensive and costly in the

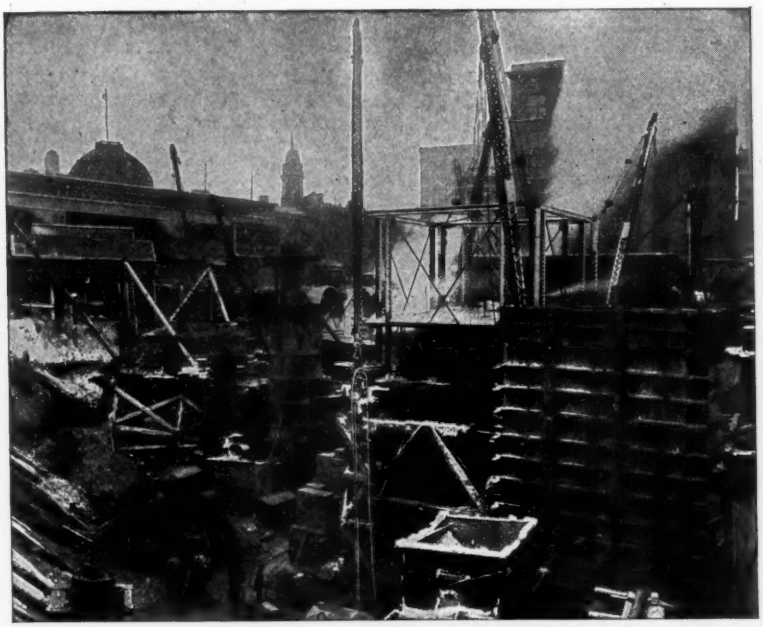


FIG. 2.

world has been recently completed and another which promises to surpass it is being rapidly pushed. There is a new courthouse of colossal size to be erected when a site can be determined upon and the plans adapted to the location.

Our present interest is in the new municipal office building seen in Fig. 1. This will be within a hundred feet of the Brooklyn Bridge terminal and will be surrounded by the most crowded thoroughfares. It will cost over $7,000,000, housing all of the New York City Departments, except Police, Fire, Docks, Ferries and Health and will reach to a height of thirty-four stories, 540 feet above the curb.

The height and weight and the permanent character of this structure make most secure foundations imperative, while the location presents peculiar difficulties, being all of the loosest sand formation. The lot area covers over 44,000 square feet. Work upon the foundation has been in progress now for many months and attracts wide attention by the vastness and difficulty of it and the unusual methods adopted.

Much caisson work is involved and for the supply of air there are employed three Ingersoll-Rand compressors and one of the McKiernan Drill Co., with a combined capacity of 18,000 cu. ft. of free air per min. There are in all 116 caissons to be sunk to an average depth of 145 feet to reach bed rock. The rectangular caissons range from 5ft. 6 in. x 11 ft. to 28 ft. x 33 ft., apd the cylindrical ones from 5 ft. 6 in. to 14 ft. 2 in. in diameter and when sunk and completed, they will contain 55,000 cubic yards of concrete, requiring 233,750 bags of cement.

The Foundation Company's round, oval and collapsible horse shoe shaft, built in sections, has ben adopted for sinking the separate caissons. The accompanying illustrations show as well as possible the work in progress, Fig. 2 being taken from near the street level and Fig. 3 down in the excavation. The cellar bottom is within a few inches of tide water level and there is a considerable and constant seepage of water which must be pumped to the sewers above, and several large Cameron, Vertical Plunger, Sinking Pumps are employed for the purpose, these being operated by compressed air. In both half tones may be seen how those pumps are suspended from the hook of the derrick to be lowered as required at a moment's notice. The vast area of course is sub-

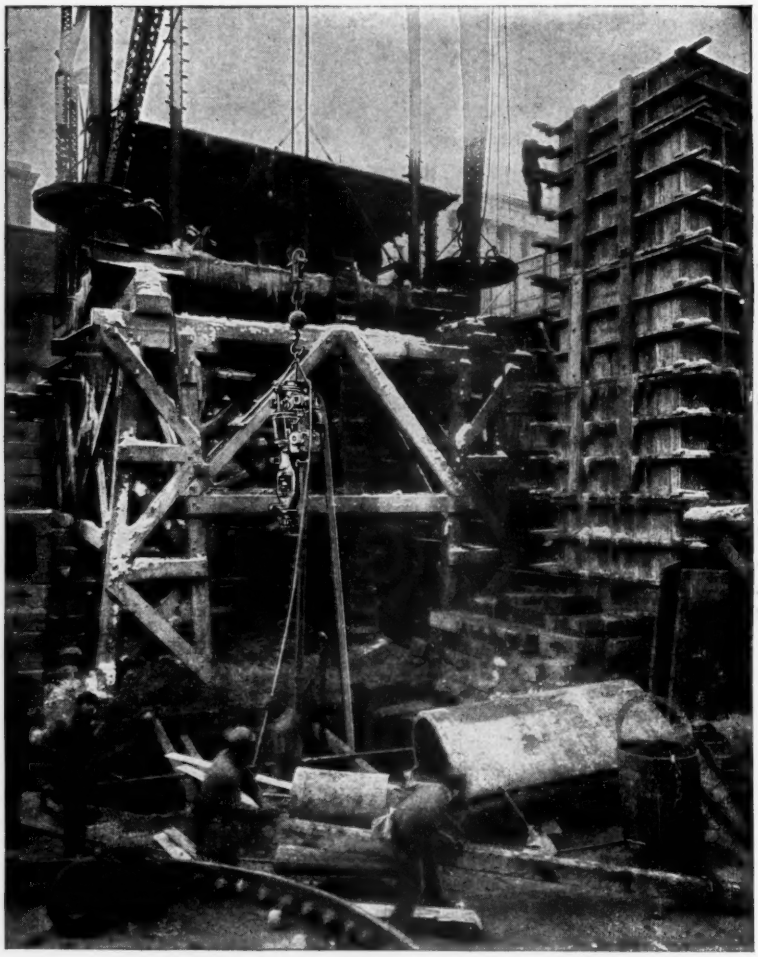


FIG. 3.

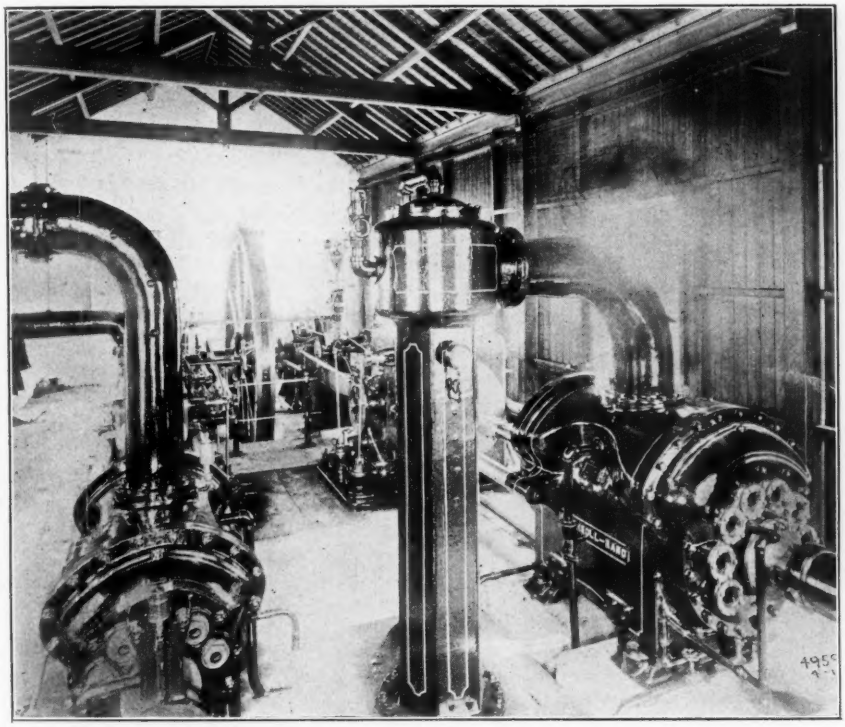
ject to large accumulations of water from rain, snow and surface flow and this also is taken care of by a number of Cameron Station Pumps located at different points.

A CAISSON PRESSURE RECORD.

Upon this work a new pressure record has been made. A caisson for one of the column piers was sunk through the sand to rock at a depth of 112 ft. 1 in. below water level without accident or casualty of any kind. The caisson, of concrete cast before sinking, and having a reinforced cutting edge, supports a concrete shaft 10 ft. 9 in. in diameter. The maximum pressure in the chamber was 47 pounds, gage. The work was executed by 20 five-man shifts working about 40 minutes each, with a very long time for decompression and an interval of 4 hours between the two shifts which each man worked daily. The men were under very strict physical and medical supervision, improved sanitary and hospital appliances were at hand and a competent physician was in constant attendance, and not even a single case of the bends occurred. This, the maximum for this building, is believed to be the deepest pneumatic caisson ever sunk.

"The Foundation Company" is the contractor and employs a double shift of men working

day and night. L. I. Brown is the general superintendent and W. S. Downing is superintendent in immediate charge of the work.



AIR COMPRESSORS AT ASTLEY GREEN COLLIERY.

DIFFICULT SHAFT SINKING

Some idea of the cost and difficulty of opening and operating a coal mine in England may be gathered from an account of the sinking of the shafts of the new colliery of the Clifton and Kersley Coal Company, at Astley Green, near Manchester, as given in a recent issue of *The Iron and Coal Trades Review.* This will be one of the deepest mines in Great Britain as the shafts are to be carried to approximate depths of 950 and 1,150 yards respectively, the depths sunk at the present writing being 259 and 149 yards. The work of sinking has been in hand two years, but for five months of that period, sinking operations were entirely suspended during the erection of the plant necessary for the installation of the drop shafting, so that, bearing in mind the peculiar difficulties contended with, the progress has been remarkably rapid. The bore-hole, which was put down in close proximity to the site of the downcast shaft, with the idea of utilising it to help to clear the shaft of water during sinking, revealed the presence of about 94 ft. of silt, immediately underlying the surface clay some 36 ft. thick. Unfortunately, one of the pipes fouled the hole during boring operations, and the cutting out of this made the bore rather worse than useless, so far as sinking was concerned; in fact, the disturbance occasioned was considered mainly responsible for the heavy inrush of sand which was experienced at one point in the work, and which, but for the exceptional provision made above ground, might easily have resulted in the loss of the shaft.

Before commencing to sink, Mr. Percy L. Wood, general manager to the Company, spent some time in Germany, visiting the collieries and studying the methods adopted in that country, he then came to the conclusion that the best means of getting through the silt was the freezing process, or, alternatively, by means of drop shafting. The first-named process naturally involves a heavy capital out-

lay; seeing, therefore, that the clay bed promised to afford an excellent foundation for the auxiliaries, the Company decided to sink by drop shafting.

Sinking operations through the clay proceeded in the usual manner, and the shaft made 23 ft. in diameter, which size was continued to the end of the drop shafting; this was to allow for possible deviation from the vertical, and to correct same, if necessary; the shaft below the cutting shoe being 21 ft. in diameter. Having completed the lining of the shaft passing through the clay, a concrete pillar, strongly reinforced with old rails and bars, was built round the shaft, encasing the brickwork.

The base of this pillar was at 51 ft., and its height clear out of the ground 18 ft.; its first duty was to carry the pressure ring, but it also forms the permanent landing level. The head gear was next got into position. An electric crane was installed which served to place the sections of tubbing in position, after they had been delivered by a locomotive jib crane.

The pressure on the cutting shoe was obtained from 12 hydraulic jacks, giving a total pressure of 20,000 tons. It is worthy of note that after the completion of the pushing-down the edge of the cutting shoe remained in perfect condition, which speaks well for the design as also for the constructive material employed. The shoe was, however, left in position, as, owing to the nature of the strata, it was considered too risky to attempt its removal, and the conical or reducing rings were joined directly up to it. From this stage until the stone measures were reached, sinking was done by means of underhanging tubbing. The hydraulic jacks were first put into service on September 21, 1908.

On October 27, the foundation of the concrete block was laid bare on the borehole side, when a subsidence of some 9 in. was found to have taken place; this was filled up with concrete. A couple of days later the ground had fallen away a further 3 in., and to make good this subsidence some 36 cwt. of concrete was teemed in. This falling away and subsequent filling up with cement continued in a diminishing degree daily until November 6, after which no further subsidence was observed.

The first feeder of water was reached on March 10, 1909, at a depth of some 94 yards, and a second feeder was reached some 10 days later. Two pumps were installed to deal with the water during sinking, one of which was equal to the total duty, the other acting as a stand-by. One of the chief advantages of the underhanging tubbing process is the fact that the feeders are tubbed off as met with. This was forcibly illustrated at a depth of 105 yards, when, before the holes above the ring were plugged, 29,500 gallons of water per hour had to be pumped, and this, by means of the tubbing, was reduced to 5,000 gallons per hour, the water pressure being 92 lbs.

The tubbed portion of the shaft has a very neat and workmanlike appearance, and at the present time the bottom of the shaft is quite dry, though there seems every probability that a heavy feeder will be tapped somewhere in the neighborhood of 400 yards, which will, of course, have to be pumped.

The only permanent portion of the plant installed at the time of our representative's visit was a fine pair of air compressors by the Ingersoll-Rand Company. These, which we illustrate are of the cross-compound Corliss type, having compound condensing steam cylinders 17 in. and 38 in. in diameter, with compound air cylinders 32¼ in. and 20¼ in. diameter and a stroke of 42 in. The machine is fitted with the makers' patent piston inlet valves and poppet-type discharge valves. Its maximum capacity is 3,183 cubic feet of free air per minute, running at 78 r.p.m., with a maximum steam pressure of 160 lbs., and a maximum air pressure of 100 lbs. The total indicated horse-power is 560.

TUNNEL DRIVING RECORDS

At at recent meeting of the Railway Club of Pittsburg, Mr. R. B. Woodworth read a paper upon tunnel design and construction in which he brought together a number of the most notable tunnel driving records. The interest in speed records in rock tunneling is due to the fact that the time needed to complete the entire tunnel, and consequently the period during which vested capital lies idle, is wholly dependent on the speed with which two small headings can be put forward; only a very small party of men can work in each heading and concentration of working forces is not possible; therefore, engineering construction looks upon speed of work in tunnel

driving as an item of supreme importance. High efficiency of tools and methods and careful attention to the prevention of delays of whatever character are the main features in the determination of tunnel progress. Natural conditions may, of course, affect the work, such as unfavorable direction of strata, fissured rock, presence of water, etc. Where the rock is firm, solid and dry, one month's work may be double the ordinary rate of advance. The record for high tunnel driving is now held by the Alpine tunnels, such as the Simplon, the Arlberg and the Loetschberg. The greater length of these tunnels and the possibility of installing a more perfect plant and a more thorough organization may account in some measure for the comparative supremacy over English and American records.

The Joker Drainage Tunnel, Red Mountain, Colo., 5,055 feet long, was driven 282 feet in its best month, July, 1904, through Andesite breccia. The heading was 12 feet by 11 feet timbered 8 feet 6 inches by 7 feet.

The drainage tunnel at the Iron Mountain Mine, Superior, Mont., 5853 feet long, was driven in 7 feet by 6 feet heading through quartzite 288 feet in one month, January, 1907. Average rate for the entire tunnel 233 feet per month. Cost per foot, $14.50.

The 6 feet by 9 feet heading of the Newhouse Drainage Tunnel, Idaho Springs, Colo., 22,000 feet long, was driven 290 feet in May, 1906, through granite and gneiss.

The best progress made in the construction of the Roosevelt Drainage Tunnel at Cripple Creek, Colo., 15,550 feet long, was 435 feet in January, 1909. Average monthly advance for twelve months, 292 feet. The heading was 10 feet wide by 6 feet high with a 3x6-foot drainage ditch on one side of the floor, the muck was taken out in steel cars of 36 cubic feet capacity on a single track railway in trains of 10 to 12 cars hauled by mules.

The Gunnison tunnel, an essential part of the Uncompahgre valley reclamation project, is the longest irrigation tunnel in the world. It is 30,582 feet in length and the headings were driven to a meeting point on July 6, 1909, as the culmination of 54 months' continuous work. The best record made was the driving of an 8x12-foot heading 842 feet in one month in soft shale. The best record in granite for any single month for one heading was 449 feet, January, 1908. The record headings were driven by the under-cut method.

The Elizabeth tunnel of the Los Angeles Water Works, California, 26,860 feet long, was driven 466 feet in granite in October, 1908. The heading was 12x12 feet, the mucking being done by hand and the tramming by electric motors. Cost per foot, $31.81.

An excellent record in driving a railroad tunnel was made in 1908 on the Bitter Root tunnel of the Chicago, Milwaukee & St. Paul Railroad, through the Bitter Root mountains, Montana. The tunnel was driven by the regular top heading method and was advanced 563.5 feet in May of 1908, the average advance for the three months of March, April and May being 499.7 feet. The rock is a quartzite somewhat laminated and the heading is the full roof arched section for a double track tunnel.

The new Croton Aqueduct has a length of 30.87 miles, of which 29.63 miles is in tunnel, being horseshoe in form, 13.53 feet high and 13.6 feet wide and carrying an estimated capacity of 318,000,000 gallons of water per day. This is the longest tunnel in the world. It was driven from shafts about a mile and a quarter apart along the length of the line, and the best record in any one heading was 550 feet per month. This was in hard rock in an unusually large heading and the ordinary progress was about 175 feet per month.

The bottom heading of the Loetschberg tunnel, 6 feet 6 inches high by 10 feet wide, is driven by machine drills mounted on drill carriges, and the rock encountered varies from granite to gneiss and is hard drilling. The record in this tunnel is 574 feet in September, 1907. Average speed for five months, 555 feet per month.

A record of 579 feet during the month of May, 1909, has been made in the Fernando tunnel, located about 25 miles north of Los Angeles and driven in connection with the construction of the Los Angeles intake through soft sandstone. The tunnel has a section of 10 feet 8 inches by 11 feet 2 inches, and the whole section is carried forward in one operation by three shifts of sixteen men each. The completed tunnel will be 9,112 feet long.

The Arlberg tunnel, in the Alps, 33,696 feet long, was advanced through schist and gneiss 641 feet in July, 1883. The average speed of

driving for 40 months was over 400 feet per month.

The world's record for rapid tunnel driving is held by the Simplon tunnel, 64,818 feet in length, in the construction of which a heading 6 feet 6 inches by 9 feet 8 inches was driven through schist and gneiss 755 feet. This figure was made in July, 1904, in the south heading, the best speed in the north heading being made in December, 1902, at the rate of 682.2 feet. In both headings the work was interrupted and delayed by bad rock, the average rate of speed of 426 feet per month for 76 month's being exceedingly good.

CLEAN AND RAPID TUNNEL WORK

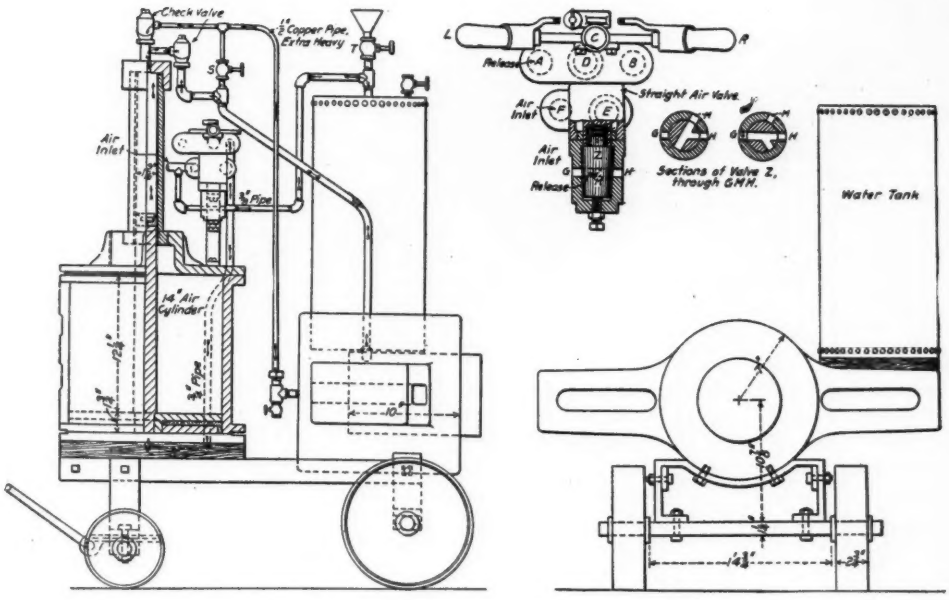
An interesting example of what can be accomplished by the judicious use of powder and gelatin is to be found in the Southwest Lake and Land Tunnel, at present under construction for the city of Chicago. The work in connection is being done by George W. Jackson, Incorporated. At the present time this tunnel extends one mile and a half under Lake Michigan, the entire bore being through tough limestone. When completed the tunnel will extend 11,000 feet under the waters of the lake and 1,265 feet under the land side, making a total of 12,265 feet. The estimated cost for the entire piece of work is $1,581,090. The work is being done by means of blasting, the tunnel section in the rough being about 16 feet, and the customary heading and bench methods are being employed. The heading and bench are about equally divided, and four Ingersoll-Rand air drills mounted on columns are used in the heading, equipped with cross bits. From April 1 to May 1, 1909, in twenty-seven working days there were driven in the heading 468 feet, establishing a daily record of 17½ feet, which is considered the world's record. There are eight center cut holes, with four helpers on each side, while to force the remnant twelve rim holes are drilled around the outside. The bench is removed with eight vertical holes, no lifters being used. In order to break this it requires an average of 225 pounds of 60 per cent. Du Pont gelatin. It takes an average of one and one-half hours to blow out and load the holes, which are filled about three-quarters. The men work in two shifts, shooting each shift. Each driller has a helper who arranges steel and makes himself useful in a general

PLAN OF HEADING HOLES.

way, though generally manipulating the feed screw. The charge is set off electrically, the current from the 110-volt light circuit being used for that purpose. When the blast has been made, a blower is turned on which quickly sucks out the gases remaining in the bore. A feature in connection with this work is the fact that few noxious gases are generated by this type of gelatin. The drillers do their own mucking back for the set up, and in turn are assisted by the muckers in tearing down. Very complete reports are kept of this work, a record being turned into the office every hour showing the distribution of all forces and covering every portion of the work. This system was introduced to catch the least leakage in the matter of cost. One blacksmith is sufficient to keep both shifts supplied with the necessary steel.—*Contractor.*

AIR OPERATED PORTABLE HYDRAULIC PRESS

The cut herewith, adapted from *The Railway Age Gazette,* shows a handy and time saving wheel press designed by John Horne, draftsman at the "Burlington" shops, St. Joseph, Mo. There is a 14-in. air piston and a 1 9/16-in. hydraulic plunger moving with it, the latter forcing water into the ram cylinder in the usual way. The air cylinder is operated by manipulating the valve, which is shown in enlarged section to facilitate explanation. When the handle is in the center, air is cut off. The handle in position R opens valve E and closes valve D, making connection to the 14-in. air cylinder through F, E, B, as shown by arrows, also closing air inlet in valve Z



PORTABLE AIR OPERATED HYDRAULIC WHEEL PRESS.

at G and making connection through H and M to the atmosphere, as shown on section of valve Z at G, M, H, raising the 14-in. air piston and the 1 9/16-in. water piston, forcing water into the ram. The handle in position L closes valve E and opens valve D, making connection B, D, A from the 14-in. air cylinder to the atmosphere; also opening the air connection on valve Z through G, H, as shown on the section of valve Z, to the top of the water tank, forcing water through the pipe at the bottom of the tank to the top of the 1 9/16-in. piston, forcing the piston down and filling it with water ready for another stroke. Each stroke moves the ram ¾ in. To force the ram back, put the handle in the center and open globe valves S, T.

HOT AIR SHOWER BATHS

Electric hot-air fans have been employed for some time in medical practice, and have undergone during the last few years most interesting alterations as regards form and use. In their original form they were used for drying hair by means of an air current produced by an electric fan, and heated by an electrical resistance.

This current of heated air was soon found to possess striking curative effects. In connection with maladies such as gout, rheumatism, neuralgia, etc., a daily application lasting ten to fifteen minutes would alleviate, and in the case of prolonged treatment, even cure these ailments. It is true that the limbs affected, being especially susceptible to cold after the treatment, had to be carefully protected by warm clothing.

Some time after the new treatment had been introduced in medicine, hot-air currents were found to exert striking curative effects on morbid tissues, and in furunculosis, abscesses, etc., on account of the hyperæmia (abundance of blood) produced by them. Thus, hot-air shower baths have been adopted in an extremely short time, not only in hospitals and sanitoria, but in the consultation rooms of specialists, as well as those of the ordinary practitioner. Their ease of handling, the readiness of the hot-air fans for use in working at a moment's notice, after being connected with an ordinary contact box, and the control of the heat effects at will by a special switch, have greatly facilitated the adoption of the shower baths. In fact, hot-air ventilators are able to generate in half a minute a strong air current up to 212 degrees F., a result impossible with any other apparatus.

The electrometrical instrument factory of Dr. Richard Heilbrun in Berlin has recently extended the use of hot-air shower baths to veterinary practice. The ventilator used in this

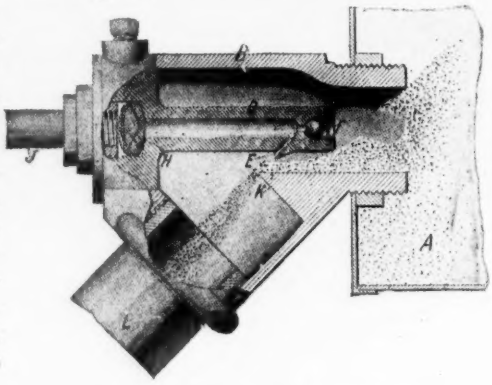
connection comprises a series-wound electromotor hidden in the handle of the apparatus. The electrical radiator heating the drawn-in air current to a temperature up to 212 degrees is carried by a connection tube 40 millimeters (1.5 in.) in diameter. The weight of the apparatus is about 2 pounds; the current consumption of the motor under a tension of 220 volts is 0.2 ampere, and that of the radiator 2 amperes. A nickel funnel, 100 millimeters (4 in.) in length and 20 millimeters (¾ in.) in diameter, fitted over the mouthpiece allows a hot-air current of increased intensity to be generated, which is particularly valuable in connection with a localized treatment. As dogs and horses are especially susceptible to catching cold, the hot-air shower bath affords an effective means of alleviating and curing their ailments, even the most nervous dogs becoming accustomed to the unusual treatment after its first application.—*Scientific American.*

COMPRESSOR VALVE RESPONSIBILITY

A short time ago the superintendent of a plant in a nearby town requested me to come over to determine, if possible, what was wrong with his air compressor. It was a duplex steam and two-stage air machine running at about 150 revolutions per minute and controlled by a combination speed and pressure governor. The air receiver had not yet arrived and the compressor was discharging direct into the line. When running at full speed it took considerable time to get the pressure up to 90 pounds and after this point had been reached the compressor continued to run at about 100 revolutions per minute. When the machine was shut down the pressure in the air line fell very slowly, which indicated that the leaks in the line did not amount to much; so it was plain that the compressor was not handling as much air as it should.

While the compressor was running I opened the safety valve on the inter-cooler and there was no pressure in it, showing that the first-stage cylinder was not compressing any air. We accordingly took out the discharge valves and found that one was broken and the rest so badly stuck to their seats that it took considerable work to get them loose, most of them having been closed tight against their seats. One set of inlet valves was also taken out and cleaned, and when all the valves had been overhauled, and replaced, the compressor was started again.

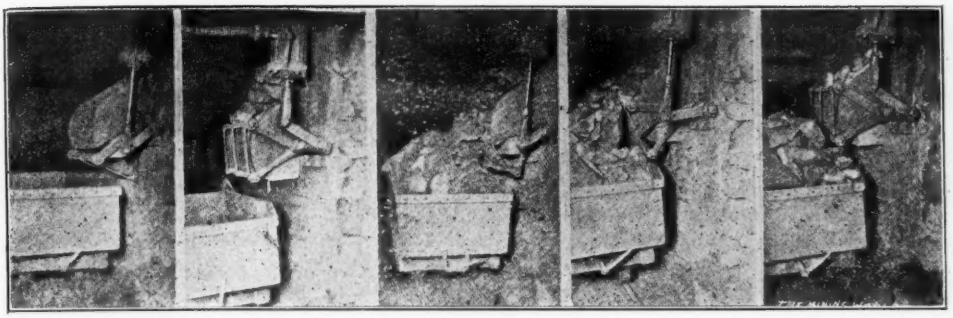
This time is worked satisfactorily, and when the pressure was up to 90 pounds it slowed down to 25 revolutions per minute.—*Power and the Engineer.*



IMPROVED TRACK SANDER

This apparatus, it will be seen, employs two jets of compressed air, one of which is directed against the sand in the box to agitate it, while the other acts to continuously expel the sand. In the cut *A* is the sand box and *B* is the sander casing which is substantially of Y form. At the rear of the casing is a plug *C* with an inwardly extending nozzle *D*. This nozzle is constricted at the end to form a jet opening into a recess in which a ball *F* is placed. There is a screen at *H* which strains the compressed air which enters by pipe *J*. The small jet opening *E* in the side and near the front of nozzle *D* will be noticed.

In the side branch of casing *B* is pipe *L* for delivering the sand upon the track. Within the casing and extending partially over the passage leading to pipe *L* is a shelf *K*. When air is admitted through pipe *J* it forces its way past the ball *F* into the sand box. A portion of the air is at the same time directed backward through the jet opening *E* producing a partial vacuum, which causes the sand which is agitated by the main jet to flow along shelf *K* and then it is carried down the delivery pipe *L*. The ball *F* prevents the constricted opening in the nozzle from being clogged with sand, and this constricted opening serves to reduce the fluid pressure by permitting its expansion past the ball *F*, so that a destructive sand blast effect is avoided.

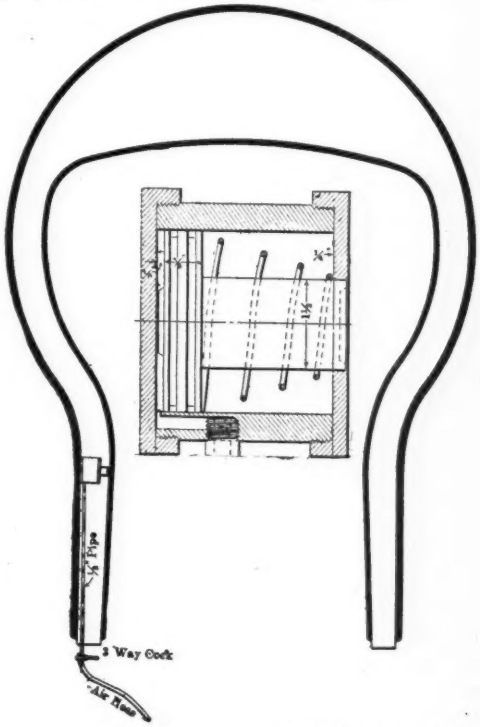


AIR OPERATED GATES ON ORE CHUTES

The half tone here reproduced from *The Mining World* shows a valuable labor saving device in use in the Crean mine of the Canadian Copper Company. Some careful engineering is required at this mine to provide convenient dumps for the rock rejected on the back stopes. With this object in view the stopes are carried one ahead of the other (*i. e.,* one higher than the other), in the form of terraces, the stopes being advanced in opposite directions to the fills, the reject of one stope forming filling for the succeeding ones. The ore-bearing rock is transferred from the chutes to the tram cars by means of air-operated gates, devised by the management (see illustration). The gate is hung radially to the lip of the chute, on a square shaft placed underneath the bottom of the lip, and held in position by means of arms which are integral parts of the gate. The bottom of the lip is about 1 ft. above the side of the tram car. When the gate is open it swings under the lip. The stream of ore flows into the car until it blocks. The car is filled to its full capacity, heaped up, but no overflow occurs. The air is turned on and the gate cuts through the pile of coarse rock, separating the rock in the car from that in the chute. No adjustment of the load is necessary. No delay occurs. Unless the chute happens to be blocked, the whole operation of loading does not consume one minute. Tram cars and skips each have a capacity of three tons, both designed to run continuously and withstand the excessive hard usage to which they are subjected.

PNEUMATIC RIVET HOLDER

A correspondent sends to *The Boiler Maker* this sketch of a pneumatic device for holding-on when riveting in close places as in the boiler leg here shown. The piston is 3 inches diameter and the thickness of the holder closed is 3½ inches. The travel of the piston, or the limit of extension for holding-on is a little over 2 inches. An air pressure of 90 pounds was available for operating.



COMPRESSED AIR QUICKENS A HYDRAULIC PRESS

There is nothing so useful around any shop as compressed air. In a certain railroad wheel shop the car-wheel work increased on the three wheel presses to such an extent that we were unable to handle it in 10 hours, and I was ordered to investigate as to what improvements could be made.

I noticed that there was considerable time

consumed in pumping the ram up to the work, although we had low- and high-pressure pumps on all of our presses. To increase the speed of the ram, I placed an old air reservoir under the floor and attached the air pipe as per sketch. This increased the output as much as 10 or 12 pairs per 10 hours.

There are no changes to make to the pump, as the water is simply pushed through the old intake connection. The air can remain while the pump is working, but it is best to release the air early, so that the ram will return promptly.—*W. A. Antlomy in American Machinist.*

CROOKED AIR-LIFT EXPERIENCE

The following is the experience of a correspondent of the *Southern Engineer*:

Last summer our bored well caved in and shut off our water supply. The well was located in the engine room and had been in use 15 years without giving trouble. It was 250 feet deep, 4½-inch standard pipe casing open at the bottom, with no strainer. We pumped water with air and got 90 gallons a minute, the total lift being 290 feet from the well to the top of the building, the tank being directly over the well. The roof of this water stratum fell in, and as there was no strainer the mud and sand rushed up in the well as fast as we could pump it out. A new well was sunk outside the building. This was 4 inches, 250 feet deep, with 30 feet of 2½-inch strainer at the bottom. The new well flowed 80 gallons a minute on the test run, the water flowing out on the ground. But as the well is 60 feet from the old one, the discharge pipe had to be run at an angle of 45 degrees to reach the tank. With this pipe arrangement we could only get 50 gallons a minute, but we finished the season, and next season we will use air to raise the water to the ground level and then a piston pump to discharge into the tank. It does very well to raise water with air as long as you can keep it going straight up, but when the discharge pipe has to be run at an angle, the water will fall to the bottom of the pipe and some of the air will pass over it, allowing some water to run back into the well.

The annual per capita consumption of coal in the United States constantly increases. In 1880 it was 1.4 tons per capita; in 1892, 2.3 tons; and in 1907 it was 5.4 tons.

VENTILATING WITH COMPRESSED AIR

The practice of turning compressed air into a ventilating pipe to induce an air current is quite general in the Cœur d'Alene mines. This is undoubtedly the simplest method of ventilating drifts when compressed air is at hand and power to operate a fan blower is not available. On the 1,200-ft. level of the Hecla mine at Burke, air is drawn in this manner 500 ft. from the face of a drift to the shaft. Twelve-inch pipe is used and a piece of ¾-in. pipe turned up at the end serves as the air nozzle. The air current is in this instance sucked 500 ft. through the fan pipe, the air jet being introduced into the fan pipe about 15 ft. above the bend at the shaft.

A different scheme is used on the 1,600-ft. level of the Mace mine. Here the air jet is applied within a few feet of the suction end of the fan pipe. In this manner a current of air is forced 400 ft. to the shaft through 8-in. fan pipe. The nozzle is, however, different in this case, being made of ½-in. pipe bent in circular shape so as to just fit around the interior of the fan pipe. The coil is drilled with a number of ⅛-in. holes on the side opposite the suction end of the fan pipe. It is claimed that this acts as a more efficient nozzle and requires much less air than does turning in the air in a single jet. These nozzles may be used at a number of places in the fan pipe if one will not draw a current of air sufficient for proper ventilation.—*Engineering and Mining Journal.*

From being originally a very simple proposition the manufacture of high-grade tool steel has become one of the most complex metallurgical problems known to science. The up-to-date steel maker searches the entire world for material to make these complex alloy steels: manganese from Russia, silicon from France, chromium from Germany, tungsten from Colorado, Spain and Australia, vanadium from South America—in fact, no corner of the earth is overlooked, and the search for steel-making materials is as thorough even as the search for gold.

The lowest atmospheric temperature ever observed, -68 deg. C., (-90.4 deg F.), was recorded on January 15th, 1885, at Werchojansk in Eastern Siberia, a little north of the Arctic Circle.

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EVERYTHING PNEUMATIC

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FRANK RICHARDS, - - Managing Editor
L. I WIGHTMAN, - - - Business Manager
W. C. LAROS, - - - - Circulation Manager

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CORE-DRILL ECONOMICS

In considering schemes and operations having to do with the material constituents of the earth's integument, perhaps nothing can be more suggestive and helpful to have at hand than an 8-inch terrestrial globe. It offers special facilities for us if we wish to do our thinking to scale, which is really more necessary than drawing or working to scale, as correct thinking must precede successful and profitable accomplishment.

On this 8-inch globe, 1 inch in any direction will represent very closely a thousand miles; and one-thousandth of an inch, or, say, one layer of the thinnest tissue paper, therefore, will represent one mile, covering practically our utmost penetration and knowledge of the earth's crust. The deepest coal mine in the world is not more than three-quarters of a mile down, and none in the United States has reached half through our sheet of tissue paper. This may help us to realize how infinitesimal are our most boasted operations, in comparison with the bulk of the body whose skin we have so imperfectly scratched, and it suggests how saving we should be of our efforts, that none of our time or strength should be wasted.

The most valuable of all devices as yet in sight for the revelation of Nature's cunningly hidden treasures is undoubtedly the core drill.

It is of unspeakable value to the miner and prospector in locating veins and revealing deposits previously unknown. Not the least of its value lies in the determination of where not to sink shafts or run tunnels, thus saving unnecessary labour.

An obvious suggestion in connection with the work of the core drill is that its own results should be systematically recorded and kept available for future consultation, so that other prospectors in the same neighborhood or investigators of the same strata should have the benefit of the preceding labour without being obliged to do the work over again. It would seem to be an open question whether the records of the core drill, however and by whom made, should be regarded as the exclusive property of those with whom they have been originated, or whether they are not subject to the general claim of the mass of humanity which is beginning to crowd the earth and must live by what can be drawn out of it.

The systematic arrangement and preserva-

tion of such core samples or records would seem to be one important service which could, and should, be rendered by the new Bureau of Mines. We should never be satisfied for this important bureau to be merely an accumulator of records after the event. It should be able also to indicate some, at least, of the opportunities of the future, and thus promote more gainful practice in working beneath the surface of the earth, just as the Department of Agriculture is doing much to make farms more remunerative.

Immense sums have been and are being most commendably spent by the government in mapping the surface of the land, and, to some extent, in determining its elevations and depressions. Expenditures for this purpose must not only be regarded as legitimate, but would be insisted on by popular opinion, if any attempt were made to curtail them. Why should we not also advocate the mapping of the earth below the surface within practically accessible depths? We can only imagine what would be the result if the Bureau of Mines had a thousand core drills continually at work, intelligently located and directed, and could thus be able to furnish accurate tabulated information for the benefit of future development and work.

For exploration and official record service, as here suggested, the core drill might begin where the air driven rock drill is now compelled to leave off, at the lowest depths of the deepest mines. Where temperature and other conditions bar the further descent of men for active work the core drill might then begin and double the distance. If the findings should prove promising there can be little doubt that ways of reaching downward would develop and the world would be the richer.

GAS POWER TRANSMISSON

In pumping oil through pipes it is usual to pump it a certain distance and then use a relay pump for the next stage. In handling gas this is not as efficient a method as to compress the gas at the first station to a maximum density. The amount of gas that can be passed through a line between given points depends upon the difference between the squares of the initial and discharge pressures. It is much more economical to pump the gas with one high-stage compression at the initial end than to relay it with several low-stage compressions. The practical result of this experience is that the compressor plants are placed in locations convenient to the wells, and the gas is forced through the transporting lines to the immediate vicinity of consumption, where the pressure in the city distributing lines is regulated by equalizing valves.

The principal cost of transporting gas—or, as it really is, power—through pipe lines is evidently the interest on the capital required, depreciation and maintenance. That there are many instances where this is much lower than rail or water haulage of an equal amount of power is unquestionable. Whether it is less than the electric methods is a mere guess, as the companies which own the pipe lines have been very secretive about costs and maintenance charges. That it has been, and is, extremely profitable, is proved by the earnings of the companies which supply many cities in the territory served by the Pittsburg and West Virginia district.

Conservative investors have refrained from advocating the securities of these gas companies, not because the efficiency of the method of transporting was questioned, but because they were skeptical as to the continued supply of the natural fuel. As early as 1888 an English engineer, in a monograph on the then infant natural gas industry, called attention to the fact that, should the natural gas fail, the companies could erect coke ovens and send the artificial gas through their lines in place of the natural gas. It is immaterial whether the coke or the natural gas be considered the by-product of the modern improved oven, because either would pay all expenses and leave the other as a net clear profit.

Modern mechanical engineering is responsible for the fact that cities such as Cincinnati and Cleveland, located several hundred miles from the gas fields, are able to enjoy the advantages of a convenient low-priced and abundant gas fuel for commercial and domestic uses. The two principal elements which should be mentioned in this connection are the economical and efficient gas compressors and riveted pipe lines which can be constructed at a reasonable rate, but which will stand high pressures without undue leakage.

It is reasonable to predict that plants will

be constructed in the future to handle artificial gas alone, and when this is done a part of the now tremendous cost of handling and delivering coal in large cities will be eliminated, and a large economic saving will result—*Cassier's Magazine.*

A BUREAU OF MINES

The following comprises all the essential provisions of the bill recently passed and signed creating a Bureau of Mines in the Department of the Interior:

The director of the bureau shall be thoroughly equipped for the duties of said office by technical education and experience and shall be appointed by the President, by and with the advice of the senate, and shall receive a salary of $6,000 per annum; and there shall also be in the said bureau experts and other employes that may from time to time be authorized by congress.

Sec. 2. It shall be the province and duty of said bureau and its director, under the direction of the secretary of said department, to make diligent investigation of the methods of mining, especially in relation to the safety of miners, and the appliances best adapted to prevent accidents, the possible improvement of conditions under which mining operations are carried on, the treatment of ores and other mineral substances, the use of explosives and electricity, the prevention of accidents and other inquiries and technologic investigations pertinent to said industries, and from time to time make such public reports of the work, investigations and information obtained as the secretary of said department may direct, with the recommendations of such bureau.

Sec. 3. The secretary of the interior shall provide the said bureau with furnished offices within the city of Washington, with such books, records, stationery and appliances, and such assistants, clerks, stenographers, typewriters and other employes as may be necessary for the proper discharge of the duties imposed by this act upon such bureau, fixing the compensation of such clerks and employes within appropriations made for that purpose.

Sec. 4. The secretary of the interior is hereby authorized to transfer to the bureau of mines from the United States geological survey the supervision of the investigations of structrual materials and the analyzing and testing of coals, lignites and other mineral fuel substances and the investigation as to the causes of mine explosions; and the appropriations made for such investigations may be expended under the supervision of the director of mines, in manner as if the same were so directed in the appropriations acts; and such investigations shall hereafter be within the province of the bureau of mines, and shall cease and determine under the organization of the United States geological survey.

Sec. 5. Nothing in this act shall be construed as in any way granting to any officer or employe of the bureau of mines any right or authority in connection with the inspection or supervision of mines or metallurgical plants in any state of territory.

NEW BOOK

Self-Taught Mechanical Drawing and Elementary Machine Design, by F. L. Sylvester, M. E., with additions by Erik Oberg, Associate Editor of Machinery, New York, Norman W. Henley Co., 330 pages, 7x5 inch, 315 cuts. Price $2.00.

This is an excellent practical treatise on the subjects indicated, comprising the principles of geometric and mechanical drawing, workshop mathematics, mechanics, strength of materials and the design and calculation of machine details. It is clearly written, comprehensive, carefully arranged and well adapted to the use of the young man who must study without a teacher.

TIME AND COST OF ROCK DRILLING IN ALASKA

The following figures are from the annual report of Mr. R. A. Kinzie, superintendent of the Ready Bullion Mine, Douglas Island, to the Alaska United Gold Mining Company:

Stoping, 33.06 ft. drilled and 46.36 tons broken per machine-drill shift; development, 40.42 ft. and 12.07 tons; sinking, 45.08 ft. and 15.24 tons. The cost of explosives in stoping averaged about $1.95 per drill per shift; in sinking, $2.70; and in drifting, from $1.90 to $2.88. The average cost of supplies, power, repairs, etc., was $5.65 per drill per shift. On the 700-Foot Claim mine of the same company the average number of feet drilled per machine per shift in stoping was 24.99, breaking 36.94 tons of rock; and in development, 31.88 ft. breaking 7.89 tons. The cost for explosives per drill per shift varied from

$1.82 to $2.28 in stoping, and from $1.85 to $3 in development. On this mine, the cost of supplies, power, repairs, etc., was $4.68 per drill per shift.

CHARGING AIR VESSELS OF MINE PUMPS

When some mine pumps delivering 1,200 gallons per minute against a head of 1,000 ft. were first started considerable difficulty was experienced in obtaining quickly a sufficient air cushion in the air vessel of the discharge to prevent an annoying hammer. A remedy was found in an air-charging device. A length of extra heavy pipe, with blind flanges on each end, was placed alongside the pump. Connections were made from the air vessel to the pipe, and also from the column pipe and the air line in the mine. A drain was placed in the lower end of the pipe. To use this device, all connections are at first closed, except that to the air line, which charges the pipe with air at a pressure of 90 to 100 lbs. The air connection is then closed, and that to the water column opened. This allows the pressure of the water in the column to compress the air. The column connection is next closed, and that to the air vessel opened. After charging the air vessel the pipe is drained of water, and the operation can then be repeated.—*The Engineer,* London.

COMPARATIVE COST OF COAL AND OIL FUEL FOR RAILROADS

The following figures relating to the relative cost and efficiency of coal and of oil are current in California:

Two and one-half barrels of oil are the equal of one ton of coal in thermal units. In other words, the same amount of heat can be obtained from 2½ barrels of oil as can be obtained from one ton of coal. But the difference in price is very great. Coal, producing the same amount of heat per ton as 2½ barrels of oil costs in California anywhere from $6 to $8 per ton wholesale. Two and one-half barrels of oil, figured at the market delivery price of $1 per barrel, costs $2.50—a saving of from $3.50 to $5.50 on every ton of coal displaced by oil. Under the circumstances it would be impossible that any other fuel could be obtained which could displace oil, and such being the case, there is a guaranteed consumption from every railroad on the coast as long as the oil fields hold out.

RESINITE

A new maerial to which the above name has been given has made its appearance in Germany. It is produced in a variety of modifications by the union of formaldehyde and carbolic acid in connection with certain metallic salts. One special variety is used chiefly with porous materials, such as wood, paper, pasteboard, etc., and renders them hard and impermeable. Thus ordinary pine wood when thoroughly impregnated, becomes so hard that it rapidly dulls a planer. In another form it can be poured as a liquid into molds. After coagulation it is transparent, with ruby tints, infusible, and unaffected by ordinary chemical reagents. It is well adapted for making ornaments, such as hat-pin heads, imitation jewelry, and for most purposes where enamel or enamel varnish are employed. For doorplates, street numbers, signs, etc., it seems capable of rendering excellent service, being entirely unaffected by atmospheric action. A third modification is liquid, but upon the addition of a mineral acid, it solidifies in a few minutes to an elastic, homogeneous substance, which can be easily cut, turned, polished, etc. In this form resinite can replace for a multitude of purposes, horn, celluloid, vegetable ivory, and similar substances. Buttons, knife handles, mosaic designs, are some of the many objects made with this modification. When competing with celluloid, it possesses the great advantage of being noncombustible.

USES OF COMMERCIAL OXYGEN

As oxygen is now produced on a commercial scale from liquid air, the future profitable uses of it are being exploited. M. Georges Claude, of Paris, shows that oxygen can increase by 40 per cent. the yield of the reactions which serve as the base of the fixation of nitrogen by the electric arc, and it can improve the manufacture of ozone by nearly 300 per cent. A Belgium firm has ordered from the Paris Liquid Air Company three sets of apparatus for producing oxygen, each having a yield of 200 cubic yards of oxygen per hour, to be used for experiments in blast furnace working. It is estimated that unit apparatus can be produced having a capacity of 1,000 cubic feet of gas per hour, working

at a pressure of 10 atmospheres and furnishing 1.5 cubic yards per horse power hour, which would bring the price per cubic yard as low as 0.5 cent. A factory occupying not more than 60 by 100 feet could contain everything needed for producing 50,000,000 cubic yards of oxygen per annum, with about 15 employees.

ELECTRIC FLASHES AND COAL DUST IGNITION

A paper by Dr. Thornton and Mr. Bowden on "The Ignition of Coal Dust by Electric Flashes" was recently read at Newcastle. Experiments have shown that dry coal dust in bulk is a non-conductor of electricity, but when made into a paste with water it is liable to cause a short-circuiting flash if placed between electrodes. If a flash is produced—as by opening a switch—in a cloud of dust an explosion is produced. The character of the dust cloud and the strength and voltage of the current broken affects the readiness with which the dust is ignited, and at medium voltages direct current appears to be more dangerous than alternating. In view of the conclusive experiments on coal dust explosions produced by the discharge of a cannon, as carried out at Altofts, the result obtained by Messrs. Thornton and Bowden were to be expected.

TEMPERATURE TROUBLES

There is no temperature unit corresponding to a foot rule or a meter stick which can be applied successively to measure an unknown temperature as we would measure the height of a room. Two temperatures of 1 degree cannot be combined in any way to give a temperature of 2 degrees. Temperature measurement is, therefore, wholly a matter of arbitrary definition, of selecting some convenient phenomenon like the expansion of gas, which varies continuously and uniformly (as nearly as possible) with temperature changes, of providing convenient arbitrary units of subdivision, and then of observing its behavior under the same conditions which surround the unknown body whose temperature is desired. The expansion of hydrogen has been established by international agreement as our fundamental measure of temperature. The gas thermometer is, therefore, now the standard thermometer in terms of which all temperatures are expressed.

NOTES

Rio Tinto, undoubtedly the greatest single copper mine now producing, worked last year on ores having an average copper content of only 2,349 per cent. A little over a million and three quarters tons of ore were produced.

At the Alaska-Mexican mine in 1909, the machine drills working on stoping averaged 39.95 tons per drill per shift, drilling 27.16 ft. of hole; on development, they averaged 12.41 tons, drilling 34.72 ft.; and on cutting out, 15.13 tons, with 30.69 feet.

At Ugine, Belgium, in connection with Girod electric steel furnaces, there is a large forge containing nine hammers operated by compressed air. The Ram of the heaviest of these hammers weights 10,000 pounds, while the weights of the others range from 2,000 to 200 pounds.

The Atlantic Transport Liner, Minnehaha, which struck and stuck on the much dreaded rocks at the western end of the Scilly Islands, and was given up as a total loss, finally got the laugh on the maritime world by hauling off and reaching a port of safety under her own steam.

The Florida farmer receives $2.25 for a bushel of green beans, a railway gets 50 cents for the 800 mile haul to New York and the consumer pays $6.40 for this same bushel of beans. There is 35 per cent. for the grower, 8 per cent. for the carrier and 57 per cent. for the dealer.

The General Electric Company in 1909 paid for patents and patent litigation $904,207, which sum is not counted as an asset, but is charged over to profit and loss. All the company's valuable patents, franchises, and good wills stand in the balance sheet at a nominal valuation of one dollar.

The Assopus viaduct, or bridge, which forms part of a new line extending by way of Demirli to the Turkish frontier, is a structure of graceful design and picturesquely situated, 600 feet long, spanning a gorge 330 feet deep,

connecting tunnels on each side. The bridge has a grade of two per cent. with a curve of four degrees.

When one solid body glides over the surface of another, the coefficient of friction diminishes as the velocity increases, and nearly vanishes when the velocity attains a certain critical value. This diminution of friction is due to the air which partially separates the two bodies at low relative velocities and separates them completely at the critical and all higher velocities.

The dangers of atmospheric electricity in aerial navigation are attracting considerable attention. While an ordinary balloon without metal parts is not exposed to any danger as long as it floats in the air, the modern dirigibles are provided with much framework made of conducting metals. Even a balloon, however, may be charged with electricity and a spark produced when contact with ground is made, thus setting fire to the gas.

The article upon "Factory Humidifiers" in our June issue, the information coming from an English source, has brought to our attention the fact, which we should have known before, that humidifiers of the type described are produced in a much improved form and manufactured in large numbers by the American Moistening Company, 120 Franklin street, Boston, and are already in use in some 900 American factories.

The Dodson automatic shot firing machine, which does away entirely with personal exposure in this responsible and dangerous operation, is beginning to attract attention. It is the invention of Mr. C. I. Dodson, of Pittsburg, Kansas, who has had a wide experience as a shot firer. It has been exhibited to many miners and operators who pronounce it just the thing for the purpose, saving life, time and expense, without any objectionable features.

According to experiments on the reception of radio-telegraphic signals when transmitting with a spark gap in compressed air, as compared with signals received when an ordinary spark gap was used, there appears to be no advantage in using compressed air for this purpose. While the dielectric strength of the air is enormously increased, so also is the resistance to the oscillatory spark, both appearing to increase in about the same ratio.

Compressed air for signalling from the bottom of shafts to the hoisting engine room at the surface is used at the Moodna pressure tunnel of the Catskill Aqueduct. An air pipe extends up the shaft and into a cylinder alongside of the hoist runner; in this cylinder is a metal piston or plunger which strikes a gong when pressure is applied.

At Windsor, Ontario, natural gas, piped forty miles, has been turned into the mains heretofore used for the local manufactured gas. In use only the gas for lighting is purified, and this is done by individual purifiers on the premises of each consumer. The gas will be used by the people generally for fuel, but for illuminating many prefer electricity. The price of the gas is 25 cents in the winter and 30 cents in the summer per 1,000 feet.

On March 29, 1910, the Penberthy Injector Company numbered its six hundred thousandth Penberthy Automatic Injector, by far the highest number of injectors manufactured by any one concern in the world, and the combined capacity of which is so great as to be almost incomprehensible to the average person. A computation has been made of the combined water capacity of this multitude of injectors and it is found to actually equal one-third of the flow of Niagara.

The United States Navy Department has decided upon removing from the active list fifty million dollars' worth (at least that is what they cost, and not very long ago) of war ships, comprising 11 protected cruisers, 3 unprotected crusiers, 10 monitors and a group of smaller craft. These are "no longer to be regarded as fighting ships." They are said to be "rusty, costly, and ineffective, and if they were sent against an enemy they would be of no practical use."

Compressed acetylene is prepared by using steel cylinders filled with a porous mixture of infusorial earth, special wood charcoal and a suitable binder, and forcing into these cylinders the acetone and then the acetylene. At ordinary temperature and pressure the acetone

dissolves 24 volumes of acetylene, which is increased about 12 times at 12 atmospheres. The cylinders have capacities of about ⅛, ½ and one cubic foot, and contain respectively 12, 50 and 100 cubic feet of acetylene measured at atmospheric pressure.

The effect of high temperature and humidity on men working underground should be carefully studied by all mine superintendents. At a high temperature in saturated air, it becomes difficult for miners to remain, even without working. A temperature of 90 deg. in saturated air is a practical limit above which no work can be done. On the other hand, it is a fact that if the air is dry, much higher temperatures can be borne with comfort. In many coal mines, where the air is dry and in motion, men can work in a temperature ranging from 100 to 120 degrees.

Contractors are being asked to bid for the construction of five drainage canals, aggregating about 235 miles, for the lowering of the level of Lake Okeechobee, Florida. The contract for this mammoth enterprise will be let in a few weeks. The construction of these canals will require the excavation of approximately 18,000,000 cubic yards of earth and 6,000,000 cubic yards of rock. The five canals will be known as the North New River, the South New River, the Miami branch, the Hillsborough canal and the Gulf Coast canal. These canals will vary in width from 50 to 70 feet and range in depth from 8 to 12 feet.

The new ore and coal docks at Rio de Janeiro, which will handle 90 per cent. of the Brazilian business in these commodities, are to be constructed and equipped by an American. This contract was awarded by a commission after an exhaustive study of the methods of both Europe and America. A Brazilian engineer has been quietly conducting this investigation during the past year, and he is now on his way home, carrying with him the full plans and details of new quays and equipment. The amount to be spent in equipping this piece of work is about $15,000,000. The fact that in the expenditure of this vast sum no competition was asked for is regarded as a distinct triumph for American methods and equipment.

LATEST U. S. PATENTS

Full specifications and drawings of any patent may be obtained by sending five cents (not stamps) to the Commissioner of Patents, Washington, D. C.

MAY 3.

956,535. PNEUMATIC CLEANER. AUGUSTUS LOTZ, San Francisco, Cal.

956,627. ART OF TUNNEL CONSTRUCTION. JOHN P. CONKLING, New York, N. Y.

956,648. DEVICE FOR AERIAL NAVIGATION. HENRY C. SCHANZE, SR., Camden, N. J.

956,784. PORTABLE VACUUM-PUMP. JOSEPH H. TEMPLIN, Philadelphia, Pa.

956,789. DISCHARGE-VALVE FOR ELASTIC-FLUID COMPRESSORS. JAMES ALLAN, Omaha, Nebr.

956,839. METHOD OF PUMPING AIR OR OTHER FLUID. THEODORE WIEDEMANN and JOSEPH H. TEMPLIN, Philadelphia, Pa.

2. The method of producing and maintaining a variable vacuum, which consists in exhausting air from the vacuum space by producing alternately higher and lower pressure within a given space, separating the impurities from the air in the vacuum space, and in limiting the lowest pressure in said given space by the amount of space which it contains.

956,862. VACUUM DUST-REMOVER. JOHN G. MEYER, Portland, Oreg.

957,019. TRACK-SANDER. JOHN H. WATTERS, Augusta, Ga.

957,084. AIR-COMPRESSOR. ALFRED T. NEWELL, Birmingham, Ala.

In a non-rotatable air-compressor, the combination of inner and outer circular concentric tracks, an axle pivoted at one end at the center of said tracks and extending radially over the same, a roller carried by said axle and located on the inner track, pumps under said track, having operating means actuated by the passage of the roller thereover, and a motor mounted on the outer track and connected to the outer end of the axle.

957,126. PNEUMATIC COTTON-SEED CONVEYER. BENJAMIN W. TILLEY and BENJAMIN F. TILLEY, Bearcreek, La.

957,129. COMPRESSOR. GOVERNOR D. WARREN, Denver, Colo.

MAY 10.

957,194. AUTOMATIC PNEUMATIC CHUCK. NATHAN M. DOEN, Lynn, Mass.

957,197. HUMIDIFIER. JOHN W. FRIES, Winston Salem, N. C.

957,205. AIRSHIP. RUDOLPH GENDTS, New York, N. Y.

957,227. ELECTROPNEUMATIC AIR-BRAKE SYSTEM. GEORGE MACLOSKIE, Schenectady, N. Y.

957,269. VACUUM-TRAP. LESLIE P. STRONG, Cleveland, Ohio.

957,304. PNEUMATIC PRESSURE APPARATUS FOR WATER-TANKS. RALPH B. CARTER, Haworth, N. J.

957,339. FLUID-PRESSURE MOTOR. HARRIS B. HOLT, Pittsburg, Pa.

957,385. AIR-HOSE COUPLING. EUGENE W. SHAW, Weir, Kans.

957,430. HUMIDIFIER. EDWARD MAXWELL, Montreal, Quebec, Canada.

957,558. VACUUM-FILTER. MARTIN E. HILTNER, Deadwood, S. D.

957,607. FAN-BLOWER. SAMUEL HIGGINS, Milwaukee, Wis.

957,656. MECHANISM FOR ELEVATING LIQUIDS. MARTIN J. CHRISTENSEN, Chicago, Ill.

957,685-6. CONDENSING FLUID SUBSTANCES. ALBERT G. KALB, Chicago, Ill.

957,708. IMPACT-TOOL. JOHN J. PADBURY, Philadelphia, Pa.

957,751. PNEUMATIC MOTOR. THOMAS DAN-

QUARD, New York, N. Y.

957,752. REGULATOR FOR PNEUMATIC MOTORS. THOMAS DANQUARD, New York, N. Y.

957,804. VACUUM-SUPPORTING DEVICE. FLORENCE P. SCHROEDER, Berkeley, Cal.

957,849-50. DESICCATING FLUID SUBSTANCES. ALBERT G. KALB, Chicago, Ill.

1. In apparatus for desiccating fluid substances means for forming a current of air and maintaining said air in motion by constantly renewing the same, means for spraying the air with the fluid being treated, means for collecting part of the desiccated material, means for spraying the air and the residue of the particles carried by it, and means for forcing said sprayed air through the fluid being treated substantially as described.

958,555. HUMIDIFIER. ROBERT P. SMITH, Winchester, Mass.

958,669. PNEUMATIC HAMMER - SUPPORT. HARRY NEVILLE, Los Angeles, Cal.

958,697. ATOMIZER. FRANK C. DORMENT, Detroit, Mich.

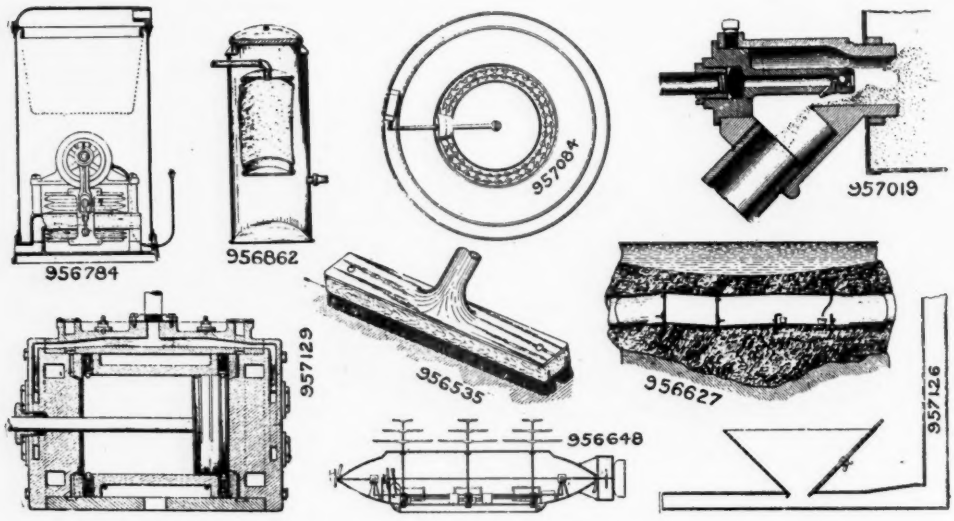
958,705. BLOWING-ENGINE OR COMPRESSOR. GEORGE MESTA, Pittsburg, Pa.

MAY 24.

958,747. FLYING-MACHINE. JOHN KOSKINE, Detroit, Mich.

958,769-70. PROCESS OR METHOD OF PURIFYING OR CLARIFYING WATER. WILLIAM K. RICHARDSON, Leavenworth, Kans.

2. The process or method of purifying and clarifying water, which consists in subjecting water to the action of centrifugal force in the presence of air under pressure, aerating and discharging the pure water by pneumatic pressure, and separately discharging the precipitate by pneumatic pressure, substantially as described.



PNEUMATIC PATENTS, MAY 3.

MAY 17.

957,957. MINING-MACHINE. JOHN C. HIRST, Reynoldsville, Pa.

958,133. STERILIZER AND DRIER. AAGE JENSEN, Eureka, Cal.

958,137. PNEUMATIC STRAW-STACKER. PETER T. KIRKPATRICK, Battle Creek, Mich.

958,184. PROCESS FOR QUENCHING COKE. EDUARD SCHULTE, New York, N. Y.

1. The process of cooling combustible substances, which consists in closing them within an air-tight casing containing a cooling medium and inert gases, and circulating said gases in a continuous circuit in contact with the combustible substances and the cooling medium.

958,240. CARRIER FOR PNEUMATIC-DESPATCH-TUBE APPARATUS. MERTON L. EMERSON, Braintree, Mass.

958,345. VACUUM-PUMP. JOHN T. WILKIN, Connersville, Ind.

958,393. ENGINEER'S VALVE FOR PNEUMATIC SANDERS. JOHN H. HANLON, Somerville, Mass.

958,428. METHOD FOR BURNING GASES. HENRY E. PARSON, New York, N. Y.

958,429. FURNACE FOR BURNING BLAST-FURNACE GASES. HENRY E. PARSON, New York, N. Y.

958,460. AIRSHIP. LOUIS ARNHEITER, Jersey City, N. J.

958,536. SPRAYING ATTACHMENT. CHARLES H. RATH, Philadelphia, Pa.

958,814. DRILLING-MACHINE. NILS D. LEVIN, Chicago, Ill.

958,867. CAP FOR VALVE-STEMS FOR PNEUMATIC TIRES. GEORGE F. FOSS, Los Angeles, Cal.

958,928. AUTOMATIC JACK FOR ENGINE-BOILERS. CHARLES KENT, Pevensey, Ontario, Canada.

958,952. TUNNELING-MACHINE. GEORGE R. BENNETT, Denver, Colo.

959,010. AIR-BRAKE. THOMAS J. HENRETTA, Roanoke, Va.

959,022. REGULATING-VALVE FOR AIR-BRAKE SYSTEMS. JOSEPH C. LUNA, Oakland, Cal.

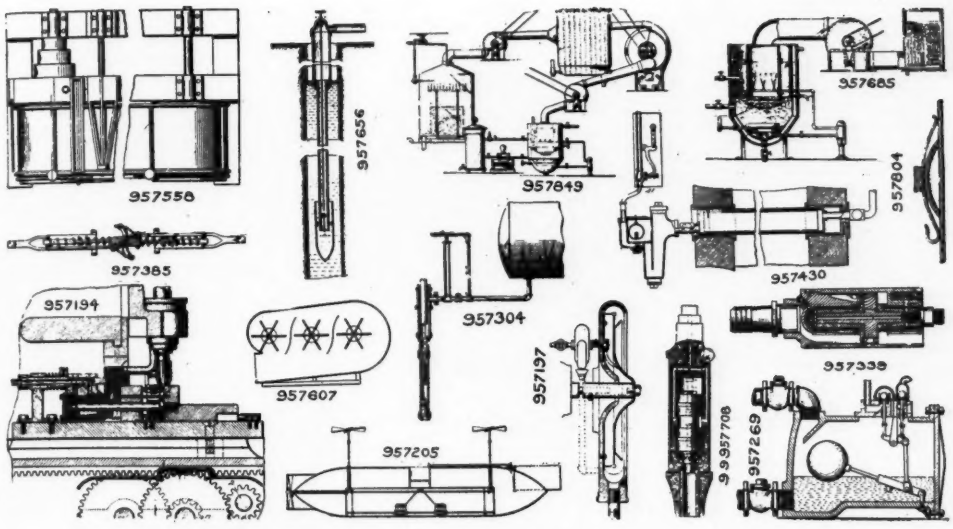
959,049. POSITIVE-PRESSURE BLOWER. FRANCIS P. BOLAND, Providence, R. I.

959,073. RELAY AIR-VALVE. HARVEY J. RICHARDSON, Chicago, Ill.

959,114. FLUID-PRESSURE BRAKE. JOHN WILLIS CLOUD, London, England.

959,122. AIR-BRAKE SIGNALING DEVICE. FRANK HUTCHINSON DUKESMITH, Meadville, Pa.

959,123-4. AIR-BRAKE-TESTING APPARATUS. FRANK HUTCHINSON DUKESMITH, Meadville, Pa.



PNEUMATIC PATENTS, MAY 10.

959,128. FLUID-PRESSURE BRAKE. FRED B. FARMER, St. Paul, Minn., and WALTER V. TURNER, Wilkinsburg, Pa.

959,209. AIR - BRAKE - TESTING SYSTEM. FRANK H. DUKESMITH, Meadville, Pa.

959,219. COMPRESSED-AIR LOCOMOTIVE. CHARLES G. HERMAN, Philadelphia, Pa.

959,266. AERIAL SHIP. FREDERICK W. SCHROEDER, Kennington, London, England.

959,363-4. OIL-BURNER. ARTHUR H. LIGHT, Los Angeles, Cal.

959,417. FLUID-OPERATED CONTROLLING MECHANISM. JOHN W. ANDERSON, Sisson, Cal.

MAY 31.

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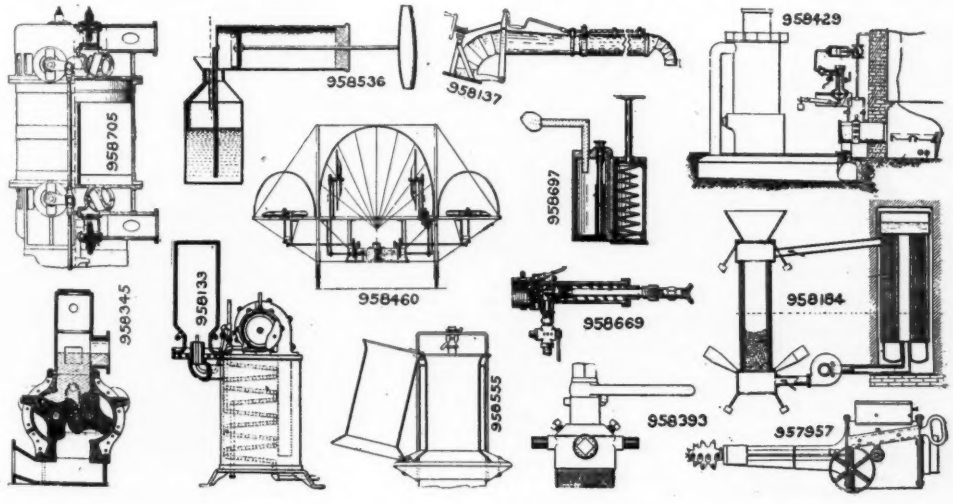

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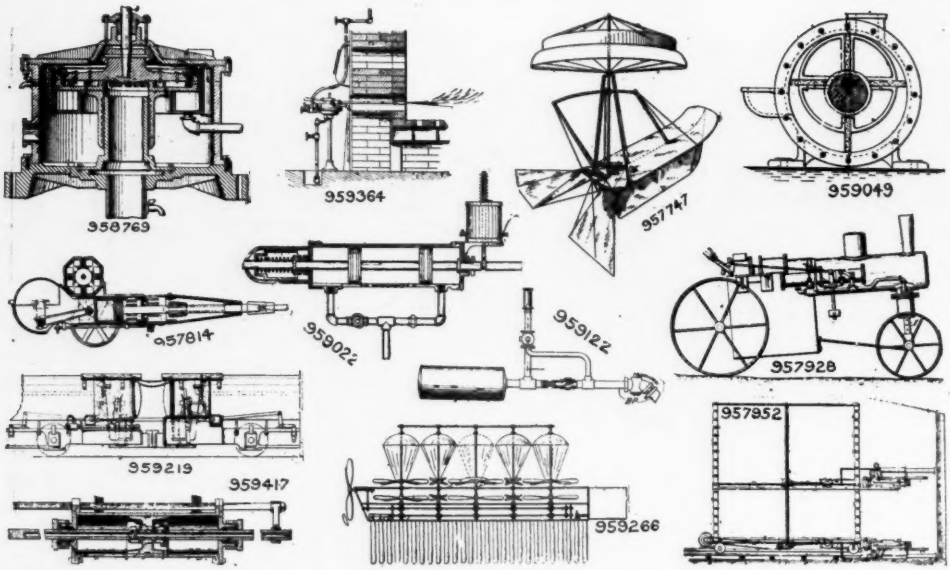

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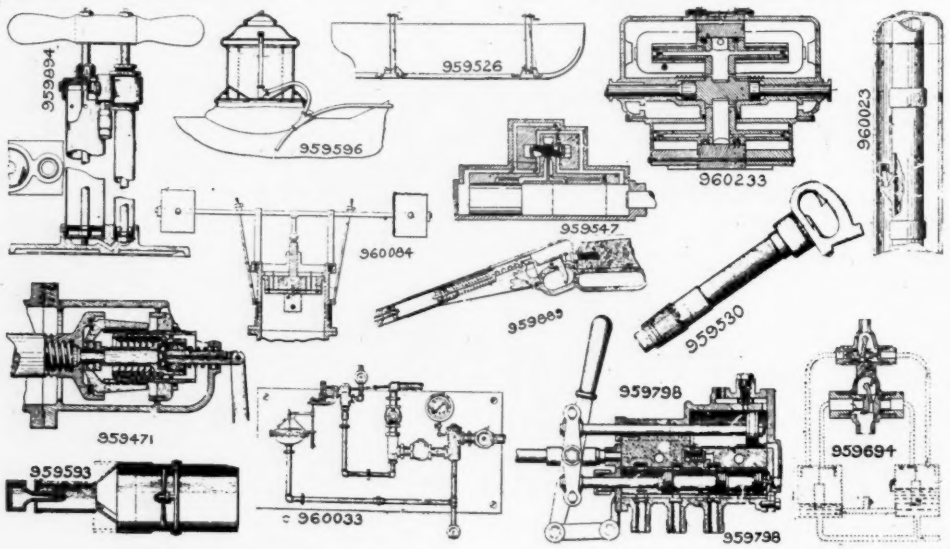

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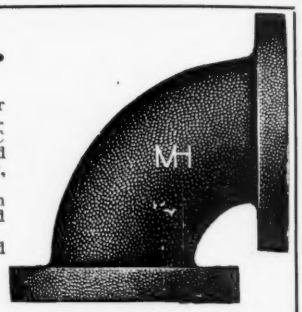

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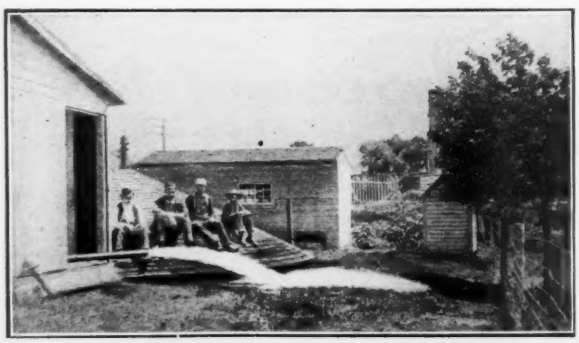

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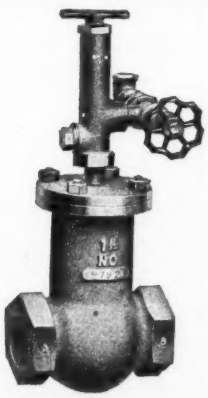

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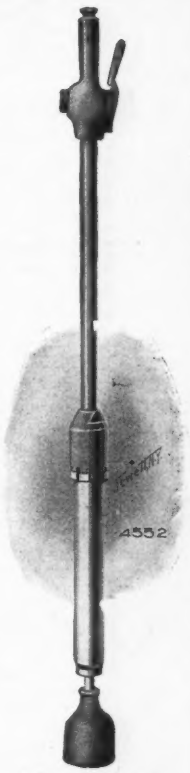

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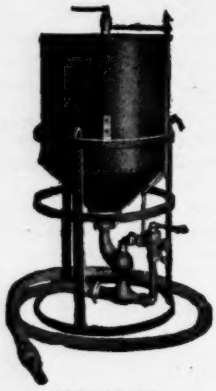

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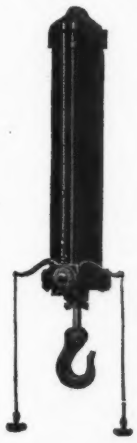

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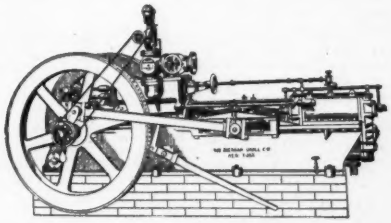

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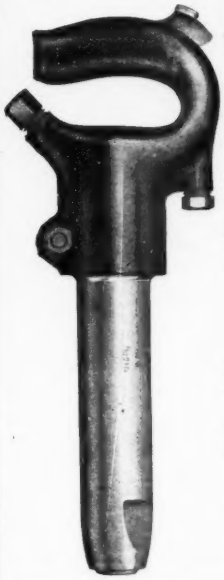

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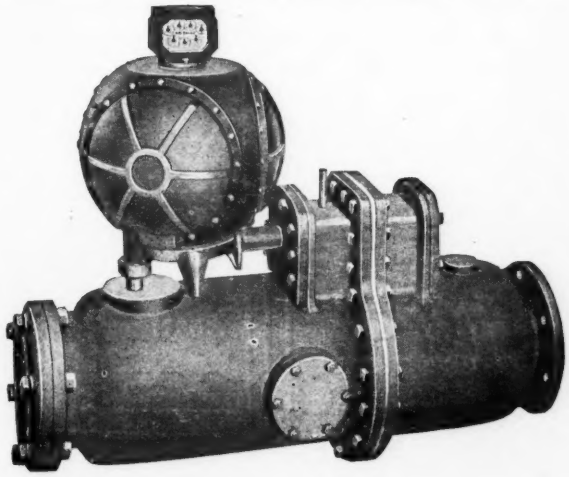

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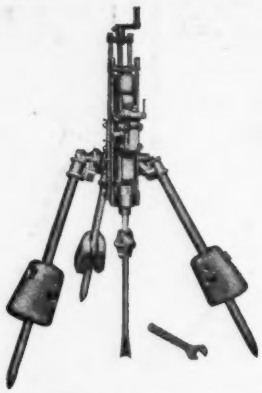

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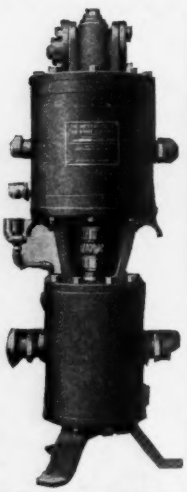

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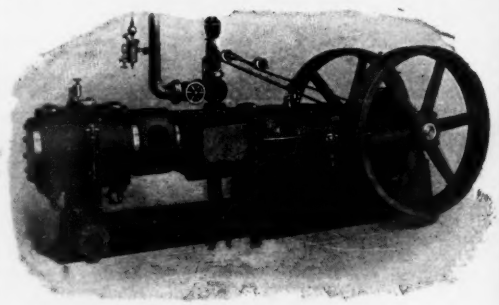

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